A Progress Report on the 1937 Tests of Copper Sulphate Injection of Ponderosa Pines on The Modoc National Forest

by

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Fifty selected living ponderosa pines on the Modoc National Forest, California, near Badger Well (T 44N R8E, Sec. 22 and 23) were treated in August and September 1937, with copper sulphate $CuSO_4 \cdot 5H_2O$. The treatments were made for tentative determinations of the reaction of these trees, individually and as a group, to attacks of bark beetles, wood borers, wood staining and other fungi, and to effects of seasoning, especially checking. Such treatments will also prove valuable as tests of general possibilities for salvage operations.

The trees were selected by K. A. Salman and B. H. Wilford. Each tree was numbered, measured, arranged into Salman's susceptibility class, and into F. P. Keen's and Duncan Dunning's tree classifications. Crown descriptions, including a sketch and the general characteristics of each tree, were prepared by A. S. West.

All chemical treatments were made by B. H. Wilford, with the assistance of three CCC enrollees from Camp Hackamore.

After a lapse of 2 weeks following treatments, 2-inch increment core samples, 1 sample on each of 4 sides of the tree stem, were taken from a point 1 foot above the chemical injection point (called the base), at a point 10 feet above the ground, and at a point 20 feet above the ground. The cores of 1 tree were taken by Wilford and those of 49 by West.

Analyses of the cores for the copper content were made by a sodium thiosulphate titration method at Asheville, North Carolina. Each core was divided from the outside into ½-inch depths. The corresponding ½-inch parts of the 4 cores at each height were

grouped together as a representative sample and analyzed together. These analyses were run by NYA employees under the supervision of Wilford and R. J. Kowal.

Approximately 6 weeks, and again 3 months, after chemical treatment West collected data regarding the foliage conditions of each of the 50 trees.

For the most part the open collar method of treatment, a slight modification of that developed by the Coeur d'Alene Station for beetle control tests, was used (Figs. 1,2, and 3). In three instances the saw kerf-rubber band method was tried. In two cases, it worked successfully; in the other, "pitching-out" required a repeat treatment with the open collar. Two trees treated with the bore-hole method pitched out and were reset with the open collar.

Twenty-five trees (201-204, 216-225, 229) were treated at the rate of 0.75 pound of copper sulphate and 0.50 gallon of water per cubic foot of wood in the outer 2 inches of tree stem. The other twenty-five (215, 226-228, 230-238, 251-260, 262-263) were treated at the same rate per cubic foot of wood as contained in only the outer 1 inch of tree stem.

15.6% by wt.

Test set-ups showed that with ponderosa pines it was unnecessary to make pitch girdles, a usual requirement in treating pitch, shortleaf and loblolly pines. Although some small leaks developed they were of little consequence and it was found unnecessary to use grease to prevent them in either the open collar or saw kerf-rubber band methods. If the collar was put on the tree a day or so before the injection girdle was made and the solution applied, leaks never occurred.

A long-handled ax was found more satisfactory than either a draw-shave or a small hand ax for making the bark-free spiral bands for the saw kerf-rubber band treatments and the bark-free horizontal bands for the open collar set-ups. Injection girdles were best made with a 2-inch wood chisel and a rubber mallet, rather than with a saw.

Old inner tubes, cut across and then split lengthwise were used for collars on several trees, and cotton cloth with rubber facing on both sides, purchased from J. C. Penney Company, was used for a few collars. Most of the collars were made of a knitted rubber sheeting, rubber center with two faces of cotton cloth, called "Penimaid" 13/139, also purchased from J. C. Penney Company. This material was more flexible and stronger than cloth with rubber faces.

The collars were held tightly to the tree with foot-long strips of 1-inch wide 20-pound roofing tin, nailed with 3-penny fine lath nails spaced about 2 inches apart. The overlap of each collar was made tight with one tin strip nailed vertically over the lap. It was found advisable not to complete the chisel girdle but to allow a 1-inch uncut surface, at the point of collar overlap, to insure a leak-proof joint. There was always sufficient lateral diffusion of the chemical to impregnate this narrow untreated band with the copper sulphate.

To simplify this preliminary report, pertinent data for each tree are arranged in brief form, one tree per page.

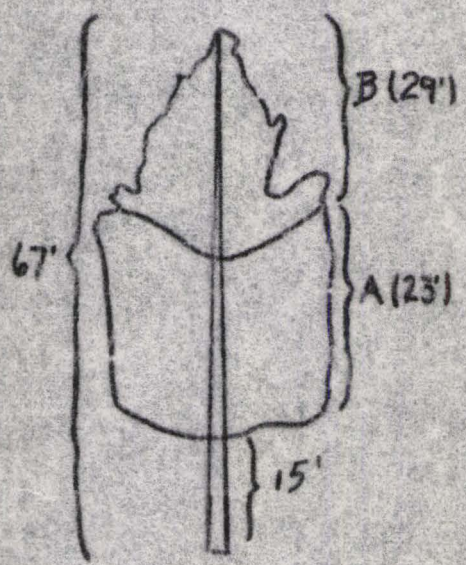
INJECTION AND EXAMIN TION DATA SHEET

Tree number 201

Crown class	D
Diameter	22 in.
Total height	67 ft.
Logs	3
Volume outer 2 in.	9 cu.ft.
Salman suscept. class	4
Keen tree class.	3A
Dunning tree class.	3

Tree characteristics:

A-fair color, medium length needles, foliage inclined to bunchiness, few dead twigs.
B-poor color, many dead needles, dead twigs, bunchy foliage, thin and short foliage, general off-color,



Date treated	8-27-37
Method	Open collar
Copper sulphate (total)	7 lbs.
Water (total)	4.5 gals.

Treating remarks:

No pitch girdle.
Empty within 2 days, 7 hrs.
Foliage faded - tree felled 9-10-37

First exam: 10-18-37

Felled.

Second exam: 12-1-37

Felled.

Results of Quantitative Analyses Showing Copper Distribution

Height: Feet	Depth-by ½"-divisions for outer 2" (from outer ⅛" to fourth ½")			
	1	2	3	4
	Pounds of copper per cubic foot			
20	.22	.07	.05	.05
10	.42	.10	.07	.07
Base	.60	.10	.05	.07

INJECTION AND EXAMINATION DATA SHEET

Tree number 202

Crown class	C
Diameter	14 in.
Total height	58 ft.
Logs	1
Volume outer 2 in.	4 cu.ft.
Balman suscept. class	3
Keen tree class.	3C
Dunning tree class.	2

Tree characteristics:

A-thin foliage, medium length needles, many dead branches, fading twigs, fair color on green needles.
B-1937 TK, brown needles, short and bunchy foliage.

Date treated	8-27-37
Method	Open collar
Copper sulphate (total	3 lbs.
Water (total)	2 gals.

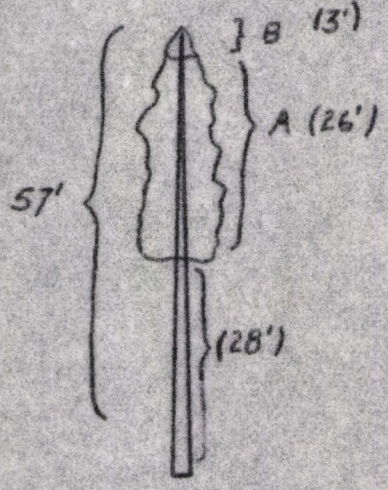
Treating remarks:
No pitch girdle.
Empty within 4 days, 5 hrs.
Sampled at 9 ft., no color on one side, light green streak on other.

First exam: 10-18-37

Little if any fade noticeable.

Second exam: 12-1-37

Sorrel lower half; heavy fade upper half; sorrel few feet TK.



Results of Quantitative Analyses Showing Copper Distribution

Height:	Depth-by ½"-divisions for outer 2" (from outer ½" to fourth ½")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.05	.10	.05	.00
10	.30	.20	.05	.05
Base	.25	.15	.05	.05

INJECTION AND EXAMINATION DATA SHEET

Tree number 203

Crown class	D
Diameter	33 in.
Total height	78 ft.
Logs	4
Volume outer 2 in.	20 cu.ft.
Salman suscept. class	4
Keen tree class.	4B
Dunning tree class.	5

Tree characteristics:
A-color good, medium length needles, few cones, dead branches at base of crown.
B-1937 fades on 2/3 of branches, remainder fair to good color, short needles, thin foliage, dead twigs on fading branches.
C-stag top.

Date treated	8-27-37
Method	Open collar
Copper sulphate (total	15.0 lbs.
Water (total)	10.0 gals.

Treating remarks:

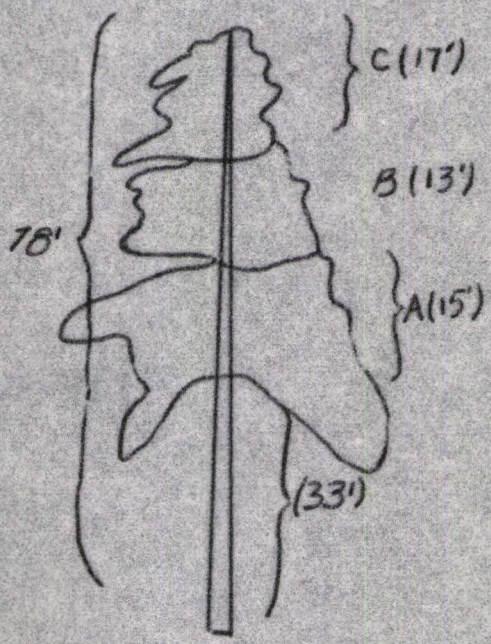
No pitch girdle.
Empty within 22 hrs.
Sampled at 8 ft.; heavy green color to depth of 3/4 in.

First exam: 10-18-37

Medium fade, spotted, not yet sorrel.

Second exam: 12-1-37

Heavy fade to sorrel throughout.



Results of Quantitative Analyses Showing Copper Distribution

Height:	Depth-by $\frac{1}{2}$"-divisions for outer 2" (from outer $\frac{1}{2}$" to fourth $\frac{1}{2}$")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.35	.00	.05	.10
10	.85	.20	.05	.05
Base	1.10	1.00	.05	.00

INJECTION AND EXAMINATION DATA SHEET

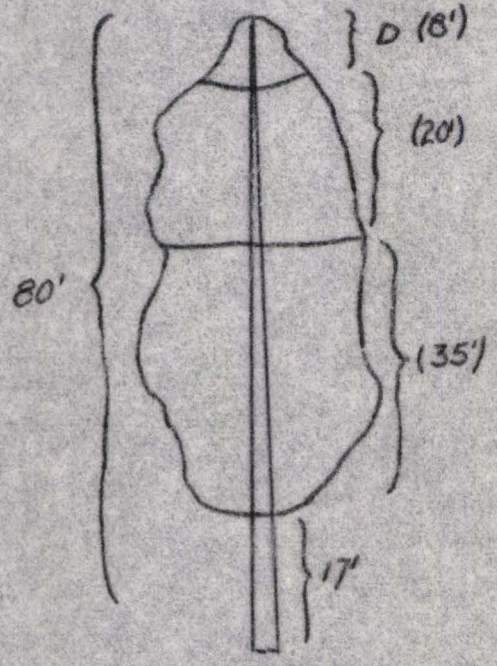
Tree number 204

Crown class	D
Diameter	20 in.
Total height	80 ft.
Logs	2
Volume outer 2 in.	11 cu.ft.
Salman suscept. class	3
Keen tree class.	2B
Dunning tree class.	2

Tree characteristics:

(fork at 52')

A-good color, medium length, needles, scattered dead branches.
B-fair color, bunchy foliage.
C-short needles, few dead twigs.
D-bunchy foliage, faded, practically a TK, short needles, dead twigs.



Date treated	2-27-37
Method	Open collar
Copper sulphate (total)	8.25 lbs.
Water (total)	5.5 gals.

Treating remarks:

No pitch girdle.
Half gone within two days; empty within 10 days.

First exam: 10-18-37

Medium fade of lower one-third to none in top one-third.

Second exam: 12-1-37

Lowest branch sorrel; fading middle bole to off-color top; sorrel few feet TK; scattered sorrel twigs throughout.

Results of Quantitative Analyses Showing Copper Distribution

Height	Depth-by $\frac{1}{2}$"-divisions for outer 2" (from outer $\frac{1}{2}$" to fourth $\frac{1}{2}$")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.25	.15	.05	.00
10	.35	.20	.05	.10
Base	.70	.40	.20	.15

INJECTION AND EXAMINATION DATA SHEET

Tree number 205

Crown class	D
Diameter	32 in.
Total height	105 ft.
Logs	4
Volume outer 2 in.	25 cu.ft.
Salman suscept. class	4
Keen tree class.	4C
Dunning tree class.	5

Tree characteristics:

A-fair color, medium length needles, bunchy foliage, few fading twigs, scattered dead branches.
B-thin foliage, very bunchy, fading twigs, faded branches in top portion, poor color, short needles, dead twigs, dead branches.
C-old stag top.

Date treated	8-28-37
Method	Open collar
Copper sulphate (total)	18.75 lbs.
Water (total	12.5 gals.

Treating remarks:

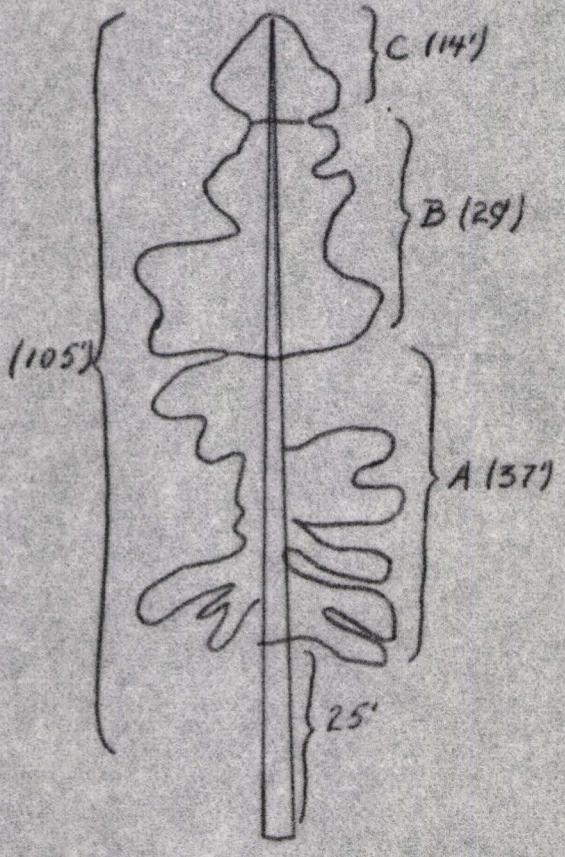
No pitch girdle.
Nearly empty within 3 days; empty within 9 days.

First exam: 10-18-37

Almost sorrel throughout.

Second exam: 12-1-37

Sorrel to red throughout.



Results of Quantitative Analyses Showing Copper Distribution

Height: Feet	Depth-by ½"-divisions for outer 2" (from outer ½" to fourth ½")			
	1	2	3	4
	Pounds of copper per cubic foot			
20	.38	.10	.00	.00
10	.20	.15	.05	.05
Base	1.40	.00	.00	.00

INJECTION AND EXAMINATION DATA SHEET

Tree number 206

Crown class	D
Diameter	18 in.
Total height	60 ft.
Logs	2
Volume outer 2 in.	7 cu.ft.
Salman suscept. class	4
Keen tree class.	2B
Dunning tree class.	1

Tree characteristics:

A-dead branches below crown.
B-poor color, medium length needles bunchy foliage, scattered dead branches, thin foliage, few faded twigs.
C-faded foliage, dead twigs, bunchy and thin foliage, short needles.
D-stag top.

Date treated	8-28-37
Method	Saw kerf-rubberband
Copper sulphate (total)	5.25 lbs.
Water (total)	3.5 gals.

Treating remarks:

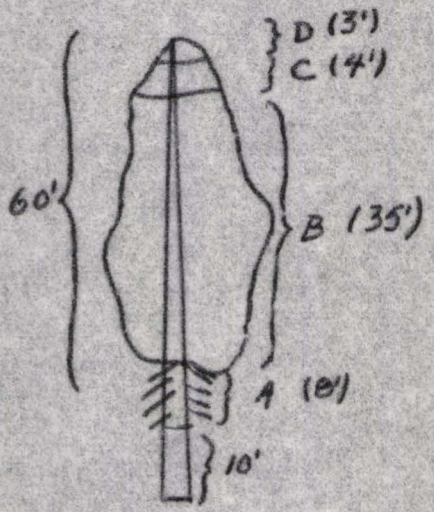
No pitch girdle.
Required 20 staples; empty within 2 days.

First exam: 10-18-37

Almost sorrel throughout with few green tips and top.

Second exam: 12-1-37

Sorrel to red throughout.



Results of Quantitative Analyses Showing Copper Distribution

Height: Depth-by $\frac{1}{2}$"-divisions for outer 2" (from outer $\frac{1}{2}$" to fourth $\frac{1}{2}$")				
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.20	.15	.07	.07
10	.25	.15	.05	.00
Base	.83	.20	.05	.05

INJECTION AND EXAMINATION DATA SHEET

Tree number 207

Crown class	D
Diameter	32 in.
Total height	95 ft.
Logs	5
Volume outer 2 in.	21 cu.ft.
Salman suscept. class	4
Keen tree class.	4C
Dunning tree class.	5

Tree characteristics:

A-foliage faded to fair in color, bunchy, medium to short needles, scattered dead branches, fading branches south and west sides and top, faded twigs throughout.

Date treated	8-31-37
Method	Open collar
Copper sulphate (total	15.75 lbs.
Water (total)	10.5 gals.

Treating remarks:

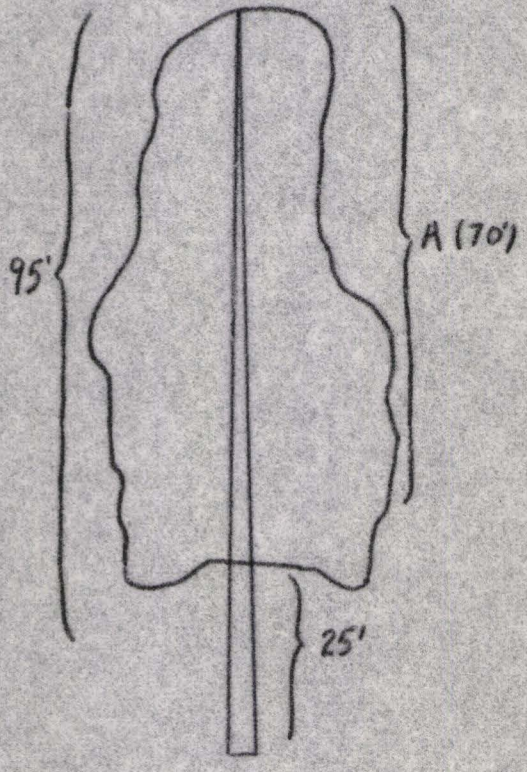
No pitch girdle.
Empty within 3 days, 6 hrs.
Tree felled 9-10-37

First exam: 10-18-37

Felled

Second exam: 12-1-37

Felled



Results of Quantitative Analyses Showing Copper Distribution

Height:	Depth-by $\frac{1}{2}$"-divisions for outer 2" (from outer $\frac{1}{2}$" to fourth $\frac{1}{2}$")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.00	.00	.00	.00
10	.92	.15	.07	.05
Base	2.60	1.12	.17	.00

INJECTION AND EXAMINATION DATA SHEET

Tree number 208

Crown class	D
Diameter	27 in.
Total height	81 ft.
Logs	4
Volume outer 2 in.	17 cu.ft.
Salman suscept. class	4
Keen tree class.	4C
Dunning tree class.	5

Tree characteristics:

A-fair color, medium to short needles, fading twigs, few dead branches.
B-active fade, short needles, bunchy foliage, dead twigs, dead branches.
C-stag top, few needles still clinging to branches.

Date treated	8-31-37
Method	Open collar
Copper sulphate (total)	12.75 lbs.
Water (total)	8.5 gals.

Treating remarks:

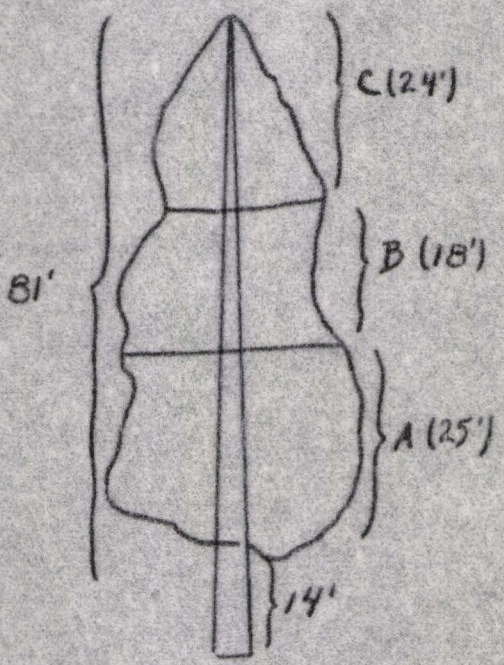
No pitch girdle.
Empty within 8 days.

First exam: 10-18-37

Sorrel in part to light fade

Second exam: 12-1-37

Sorrel throughout.



Results in Quantitative Analyses Showing Copper Distribution

Height	Depth-by $\frac{1}{2}$"-divisions for outer 2" (from outer $\frac{1}{2}$" to fourth $\frac{1}{2}$")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.30	.10	.05	.10
10	.20	.05	.00	.00
Base	.92	.10	.00	.00

INJECTION AND EXAMINATION DATA SHEET

Tree number 209

Crown class	D
Diameter	23 in.
Total height	76 ft.
Logs	3
Volume outer 2 in.	13 cu.ft.
Salman suscept. class	4
Keen tree class.	3A
Dunning tree class.	3

Tree characteristics:

A-fair color, medium needles, scattered dead branches, few faded twigs, numerous dead twigs.
B-poor color, short needles, bunchy foliage, dead twigs, fading twigs, thin foliage, general off-color.

Date treated	8-31-37
Method	Open collar
Copper sulphate (total)	9.75 lbs.
Water (total)	6.5 gals.

Treating remarks:

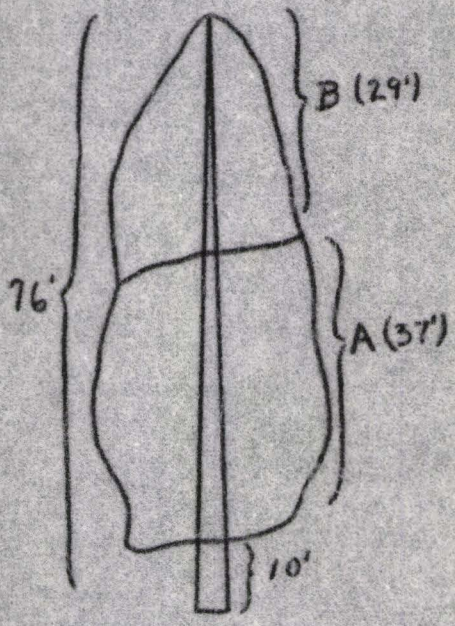
No pitch girdle.
Practically empty within 8 days.

First exam: 10-18-37

Sorrel bottom; medium fade in center to fair green top.

Second exam: 12-1-37

Heavy fade to sorrel lower two-thirds; light fade top one-third.



Results of Quantitative Analyses Showing Copper Distribution

Height: Depth-by $\frac{1}{2}$"-divisions for outer 2" (from outer $\frac{1}{2}$" to fourth $\frac{1}{2}$")				
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.10	.05	.05	.00
10	.20	.05	.00	.00
Base	.65	.10	.05	.07

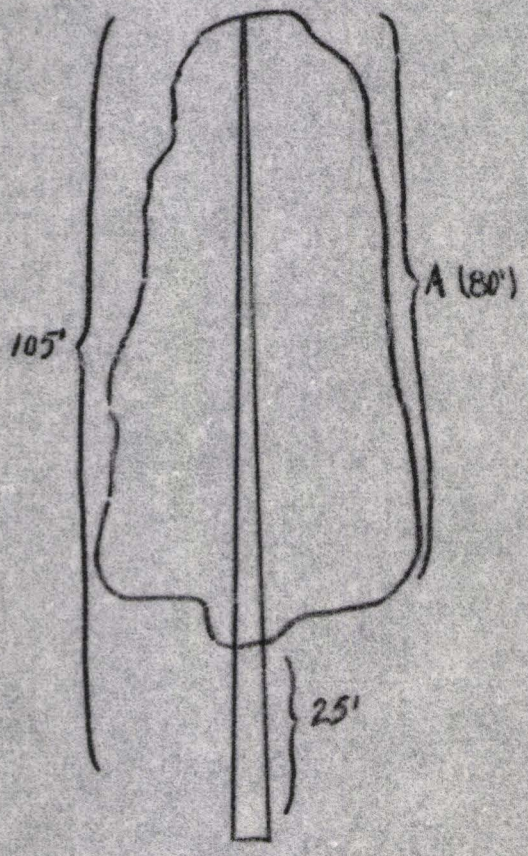
INJECTION AND EXAMINATION DATA SHEET

Tree number 210

Crown class	D
Diameter	34 in.
Total height	108 ft.
Logs	6
Volume outer 2 in.	30 cu.ft.
Salman suscept. class	3
Keen tree class.	4B
Dunning tree class.	5

Tree characteristics:

A-fair color, medium needles, bunchy foliage in top, scattered dead branches, dead twigs, fading twigs scattered but more concentrated in top.



Date treated	8-31-37
Method	Open collar
Copper sulphate (total)	22.5 lbs.
Water (total)	15.0 gals.

Treating remarks:

No pitch girdle.
Empty within 8 days.

First exam: 10-18-37

Medium fade of few lower branches with upper two-thirds showing no fade.

Second exam: 12-1-37

Sorrel lower branches; heavy fade of lower one-half; light fade of green top one-half.

Results of Quantitative Analyses Showing Copper Distribution

Height	Depth-by ½"-divisions for outer 2" (from outer ½" to fourth ½")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.25	.00	.00	.00
10	.22	.10	.10	.07
Base	1.20	.10	.05	.00

INJECTION AND EXAMINATION DATA SHEET

Tree number 211

Crown class	D
Diameter	14 in.
Total height	55 ft.
Logs	1
Volume outer 2 in.	5 cu.ft.
Salman suscept. class	4
Keen tree class.	2A
Dunning tree class.	1

Tree characteristics:

A-good color medium needles, bunchy foliage near top, scattered dead branches, faded twigs scattered through crown, dead twigs.
B-stag top.

Date treated	8-31-37
Method	Saw kerf-rubber band
Copper sulphate (total)	3.75 lbs.
Water (total)	2.5 gals.

Treating remarks:

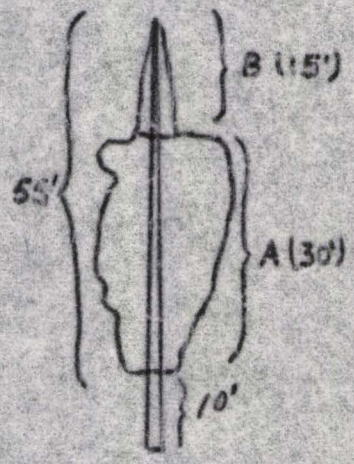
No pitch girdle.
Empty within 19 hrs.

First exam: 10-18-37

Nearly sorrel throughout.

Second exam: 12-1-37

Sorrel throughout with scattered green twigs.



Results of Quantitative Analyses Showing Copper Distribution

Height	Depth-by $\frac{1}{2}$"-divisions for outer 2" (from outer $\frac{1}{2}$" to fourth $\frac{1}{2}$")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.17	.15	.05	.00
10	.20	.15	.10	.00
Base	4.25	.17	.05	.07

INJECTION AND EXAMINATION DATA SHEET

Tree number 212

Crown class	I
Diameter	16 in.
Total height	61 ft.
Logs	1
Volume outer 2 in.	6 cu.ft.
Salman suscept. class	3
Keen tree class.	2C
Dunning tree class.	2

Tree characteristics:

A-fair color, thin crown, medium needles, dead branches in middle to bottom, scattered dead twigs, few fading twigs near top, poor color in top.

Date treated	9-1-37
Method	Open collar
Copper sulphate (total)	4.5 lbs.
Water (total)	3.0 gals.

Treating remarks:

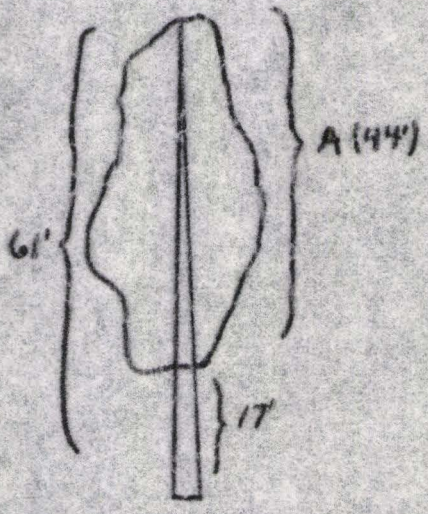
No pitch girdle.
Empty within 2 days, 6 hrs.

First exam: 10-18-37

Medium fade throughout.

Second exam: 12-1-37

Heavy fade throughout.



Results of Quantitative Analyses Showing Copper Distribution

Height	Depth-by $\frac{1}{2}$"-divisions for outer 2" (from outer $\frac{1}{2}$" to fourth $\frac{1}{2}$")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.17	.10	.10	.10
10	.25	.15	.10	.10
Base	1.35	.17	.07	.00

INJECTION AND EXAMINATION DATA SHEET

Tree number 213

Crown class	D
Diameter	34 in.
Total height	97 ft.
Logs	5
Volume outer 2 in.	26 cu.ft.
Salman suscept. class	4
Keen tree class.	4A
Dunning tree class.	5

Tree characteristics:

A-fair color, medium needles, dead branches, some bunchiness of foliage, few scattered fading twigs.
B-active '37 TK, faded short needles, bunchy foliage, dead twigs, thin crown, scattered dead branches.

Date treated	9-1-37
Method	Open collar
Copper sulphate (total)	19.5 lbs.
Water (total)	13.0 gals.

Treating remarks:

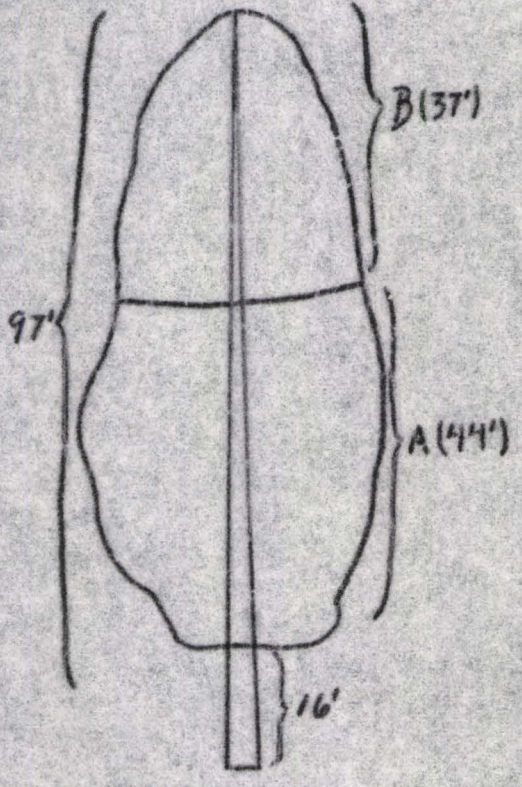
No pitch girdle.
Intake very slow; about 11 gals. taken in within 3 days and 22 hrs.

First exam: 10-18-37

Felled

Second exam: 12-1-37

Felled



Results of Quantitative Analyses Showing Copper Distribution

Height	Depth-by ½"-divisions for outer 2" (from outer ½" to fourth ½")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.22	.10	.05	.00
10	.40	.05	.00	.00
Base	.47	.05	.00	.00

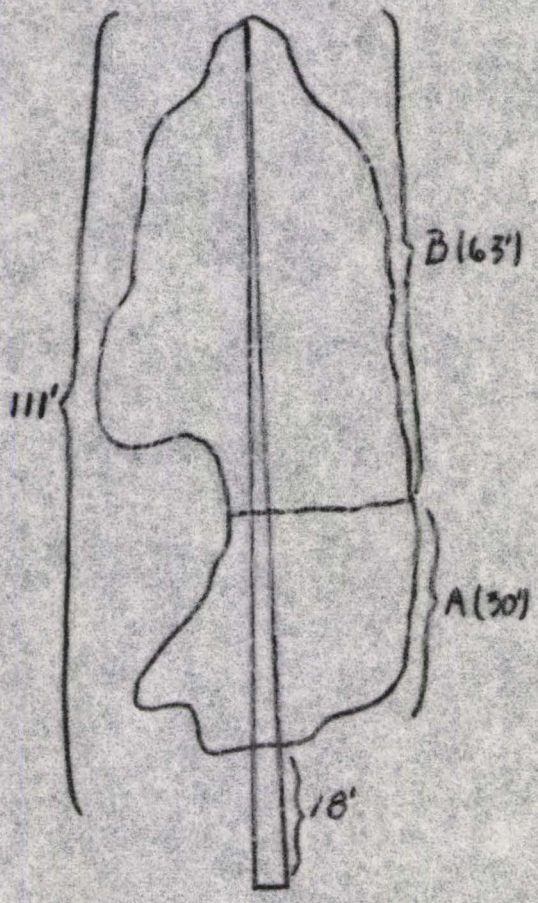
INJECTION AND EXAMINATION DATA SHEET

Tree number 214

Crown class	D
Diameter	37 in.
Total height	111 ft.
Logs	5
Volume outer 2 in.	32 cu.ft.
Salman suscept. class	4
Keen tree class.	4A
Dunning tree class.	5

Tree characteristics:

A-good color, medium needles, few scattered dead branches, few fading twigs.
B-short needles, bunchy foliage many dead twigs and fading twigs, poor color, thin crown, condition emphasized towards top.



Date treated	9-1-37
Method	Open collar
Copper sulphate (total)	24.0 lbs.
Water (total)	16.0 gals.

Treating remarks:

No pitch girdle.
One catface necessitating partial collar about 13 gals, taken in within 7 days and 8 hrs.

First exam: 10-18-37

Heavy fade of few lowest branches with slight fade of upper two-thirds.

Second exam: 12-1-37

Sorrel lowest branches; heavy fade of lower one-half; top half off color green with scattered sorrel twigs.

Results of Quantitative Analyses Showing Copper Distribution

Height	Depth-by $\frac{1}{2}$"-divisions for outer 2" (from outer $\frac{1}{2}$" to fourth $\frac{1}{2}$")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.15	.05	.00	.05
10	.40	.15	.00	---
Base	.55	.10	.05	.05

INJECTION AND EXAMINATION DATA SHEET

Tree number 215

Crown class	D
Diameter	36 in.
Total height	96 ft.
Logs	5
Volume outer 1 in.	28 cu.ft.
Salman suscept. class	4
Keen tree class.	4A
Dunning tree class.	5

Tree characteristics:

A-fair color in top and good color in bottom, medium needles, bunchy foliage in top, scattered dead branches, off-color top in portions, fading twigs S and E sides top to bottom.

Date treated	9-1-37
Method	Open collar
Copper sulphate (total)	9.75 lbs.
Water (total)	6.5 gals.

Treating remarks:

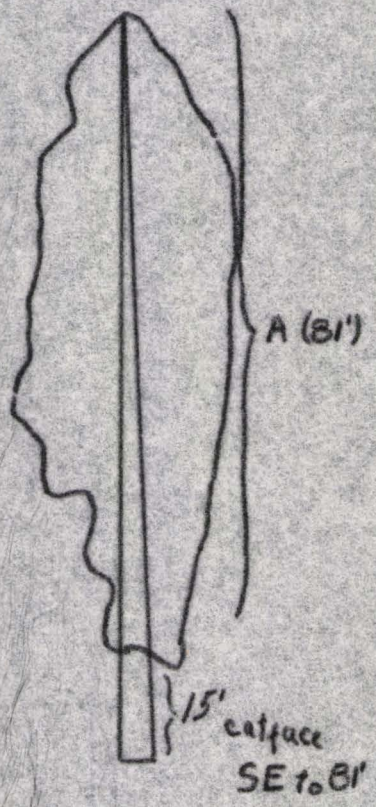
No pitch girdle.
Two catfaces requiring two partial collars. Almost empty within 7 days and 8 hrs.

First exam: 10-18-37

Sorrel bottom to medium top fade.

Second exam: 12-1-37

Sorrel throughout.



Results of Quantitative Analyses Showing Copper Distribution

Height: Feet	Depth-by $\frac{1}{8}$"-divisions for outer 2" (from outer $\frac{1}{8}$" to fourth $\frac{1}{8}$") 1	2	3	4
	Pounds of copper per cubic foot			
20	.20	.10	.00	.00
10	.27	.10	.05	.05
Base	2.15	.05	.05	.05

INJECTION AND EXAMINATION DATA SHEET

Tree number 216

Crown class	C
Diameter	20 in.
Total height	75 ft.
Logs	3
Volume outer 2 in.	9 cu.ft.
Salman suscept.class	3
Keen tree class.	3B
Dunning tree class.	4

Tree characteristics:

A-good color, bottom, to fair color, top, long needles, bottom, to medium top. Bunchy foliage, top thin crown-top, dead branches middle to bottom, few dead twigs in top, fading twigs in top one-third crown.

Date treated	9-2-37
Method	Open collar
Copper sulphate (total)	6.75 lbs.
Water (total)	4.5 gals.

Treating remarks:

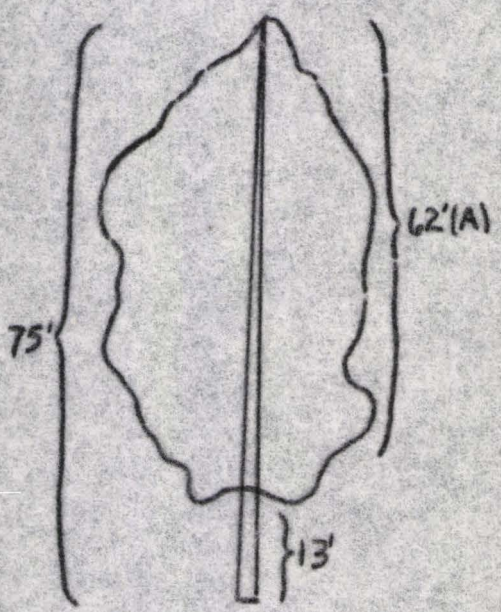
No pitch girdle.
Collar empty within 1 day, 6 hrs.

First exam: 10-18-37

Sorrel bottom to medium top fade.

Second exam: 12-1-37

Heavy fade to sorrel lower one-half; medium fade top one-half.



Results of Quantitative Analyses Showing Copper Distribution

Height : Depth-by ½"-divisions for outer 2" (from outer ½" to fourth ½")				
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.25	.10	.00	.00
10	.22	.10	.05	.00
Base	3.80	.15	.07	.13

INJECTION AND EXAMIN TION DATA SHEET

Tree number 217

Crown class	C
Diameter	22 in.
Total height	70 ft.
Logs	3
Volume outer 2 in.	10 cu.ft.
Salman suscept. class	3
Keen tree class.	3C
Dunning tree class.	4

Tree characteristics:

A-thin crown, poor color, bunchy foliage, medium needles dead branches in middle of crown, few fading twigs near top.

Date treated	9-2-37
Method	Open collar
Copper sulphate (total)	7.5 lbs.
Water (total)	5.0 gals.

Treating remarks:

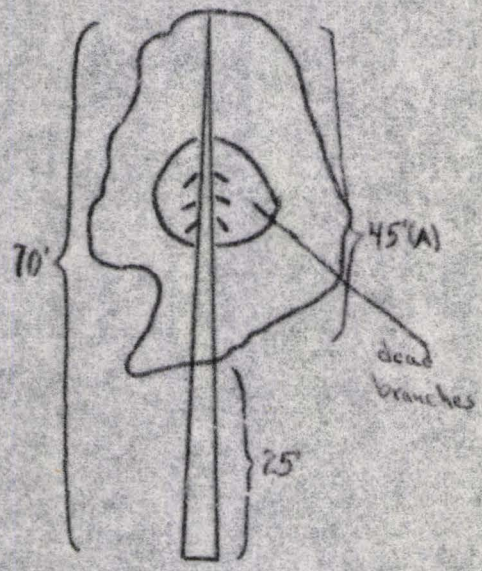
No pitch girdle.
Empty within 1 day and 4 hrs.

First exam: 10-18-37

Slight fade of bottom to none of top two-thirds.

Second exam: 12-1-37

Heavy fade and sorrel lower one-half; (with interspersed green needles) top one-half green with few sorrel twigs.



Results of Quantitative Analyses Showing Copper Distribution

Height	Depth-by ½"-divisions for outer 2" (from outer ½" to fourth ½")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.45	.13	.00	.05
10	.80	.15	.05	.05
Base	1.67	.15	.05	.05

INJECTION AND EXAMINATION DATA SHEET

Tree number 218

Crown class	I
Diameter	16 in.
Total height	63 ft.
Logs	1
Volume outer 2 in.	6 cu.ft.
Salman suscept. class	4
Keen tree class.	3C
Dunning tree class.	2

Date treated	9-2-37
Method	Open collar
Copper sulphate (total)	4.5 lbs.
Water (total)	3.0 gals.

Treating remarks:

No pitch girdle.
Empty within 1 day, 3 hrs.

Tree characteristics:

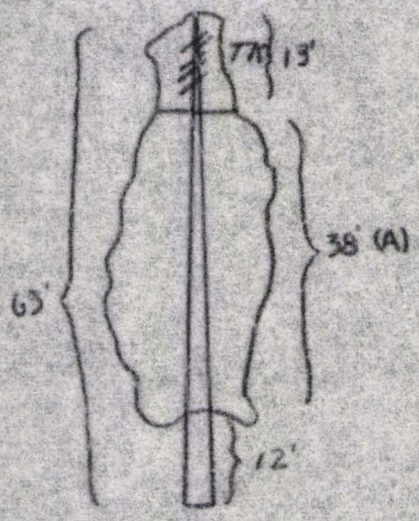
A-good color, medium needles, scattered dead branches, fading twigs near upper portion, scattered dead twigs.
B-brown foliage, bunchy, short needles, dead branches, TK.

First exam: 10-18-37

Sorrel bottom to medium fade of top two-thirds.

Second exam: 12-1-37

Sorrel throughout; red TK



Results of Quantitative Analyses Showing Copper Distribution

Height: Feet	Depth-by $\frac{1}{2}$"-divisions for outer 2" (from outer $\frac{1}{2}$" to fourth $\frac{1}{2}$")			
	1	2	3	4
	Pounds of copper per cubic foot			
20	.45	.10	.00	.05
10	.55	.07	.00	.05
Base	5.05	.10	.00	.00

INJECTION AND EXAMINATION DATA SHEET

Tree number 219

Crown class	C
Diameter	20 in.
Total height	70 ft.
Logs	3
Volume outer 2 in.	10 cu.ft.
Salman suscept. class	3
Keen tree class.	3B
Dunning tree class.	4

Tree characteristics:

A-fair color, long needles, few fading needles, dead branches, fading twigs in top portion.
B-brown, 1936, TK, short needles, bunchy foliage.

Date treated	9-2-37
Method	Open collar
Copper sulphate (total)	7.5 lbs.
Water (total)	5.0 gals.

Treating remarks:

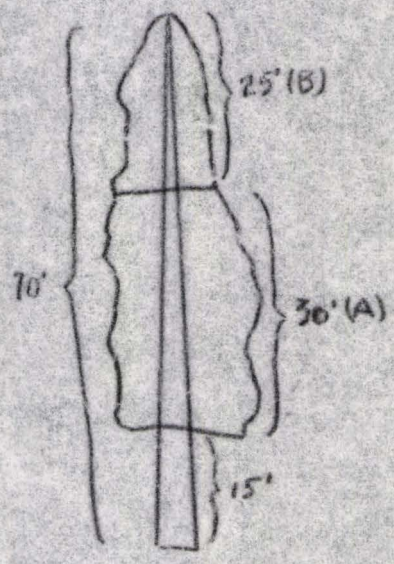
No pitch girdle.
Empty within 3 days, 22½ hrs.

First exam: 10-18-37

Slight fade throughout.

Second exam:

Partial medium fade of needles throughout.



Results of Quantitative Analyses Showing Copper Distribution

Height: Depth-by ½"-divisions for outer 2" (from outer ½" to fourth ½")				
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.47	.13	.05	.05
10	.45	.25	.00	.05
Base	.87	.13	.10	.10

INJECTION AND EXAMINATION DATA SHEET

Tree number 220

Crown class	C
Diameter	18 in.
Total height	84 ft.
Logs	2
Volume outer 2 in.	11 cu.ft.
Balman suscept. class	4
Keen tree class.	3C
Dunning tree class.	4

Tree characteristics:

A-thin crown, poor color, top, fair color-bottom, bunchy foliage, top, few fading twigs in center and top, dead branches below middle, few scattered dead twigs.

Date treated	9-2-37
Method	Open collar
Copper sulphate (total)	8.25 lbs.
Water (total)	5.5 gals.

Treating remarks:

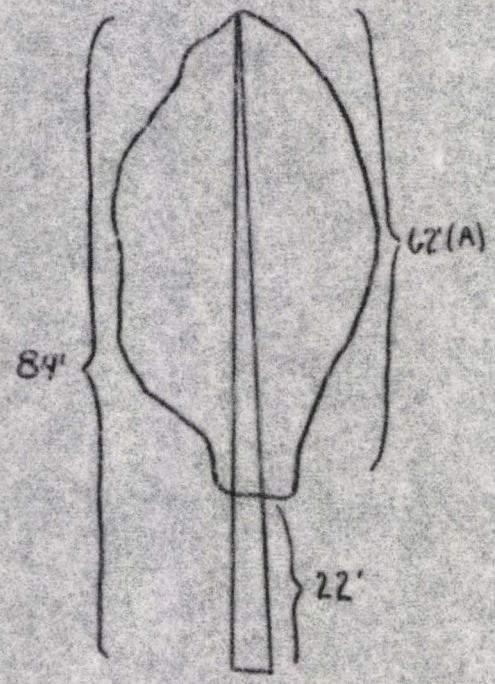
No pitch girdle.
Empty within 6 days, 18 hrs.

First exam: 10-18-37

Medium fade of bottom to sorrel top.

Second exam: 12-1-37

Heavy fade lower one-half; red TK



Results of Quantitative Analyses Showing Copper Distribution

Height	Depth-by $\frac{1}{2}$"-divisions for outer 2" (from outer $\frac{1}{2}$" to fourth $\frac{1}{2}$")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.22	.10	.00	.00
10	.25	.13	.10	.10
Base	3.70	.40	.25	.07

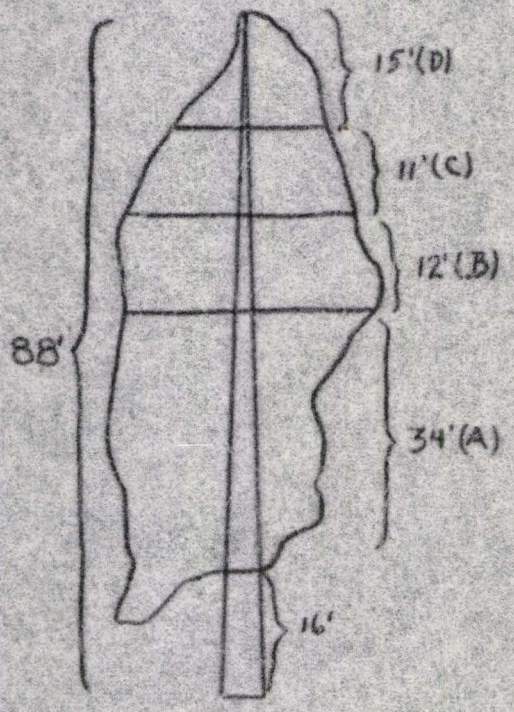
INJECTION AND EXAMINATION DATA SHEET

Tree number 221

Crown class	D
Diameter	24 in.
Total height	88 ft.
Logs	4
Volume outer 2 in.	15 cu.ft.
Balman suscept. class	4
Keen tree class.	3B
Dunning tree class.	4

Tree characteristics:

A-fair color, medium needles, dead twigs and branches, few fading twigs in upper portion.
B-general fade, medium to short needles, dead twigs and branches, thin, bunchy foliage
C-brown foliage, 36 TK? bunchy, short needles, thin crown.
D-stag top.



(SE)

Date treated	9-2-37
Method	Open collar
Copper sulphate (total)	11.25 lbs.
Water (total)	7.5 gals.

Treating remarks:

No pitch girdle.
Practically empty within 6 days, 18 hrs.

First exam: 10-18-37

Nearly sorrel throughout.

Second exam: 12-1-37

Sorrel lower one-half; red top one-half.

Results of Quantitative Analyses Showing Copper Distribution

Height: Feet	Depth-by $\frac{1}{2}$"-divisions for outer 2" (from outer $\frac{1}{2}$" to fourth $\frac{1}{2}$")			
	1	2	3	4
	Pounds of copper per cubic foot			
20	.45	.25	.07	.00
10	.45	.07	.00	.00
Base	2.02	.15	.10	.00

INJECTION AND EXAMINATION DATA SHEET

Tree number 222

Crown class	D
Diameter	14 in.
Total height	69 ft.
Logs	2
Volume outer 2 in.	7 cu.ft.
Salman suscept. class	3
Keen tree class.	2C
Dunning tree class.	2

Tree characteristics:

A-dead branches
B-fair color, short needles, bunchy foliage, dead branches, few fading twigs.
C-dead leader, dead twigs, fading twigs, poor color, short needles thin and bunchy foliage.

Date treated	9-2-37
Method	Open collar
Copper sulphate (total)	5.25 lbs.
Water (total)	3.5 gals.

Treating remarks:

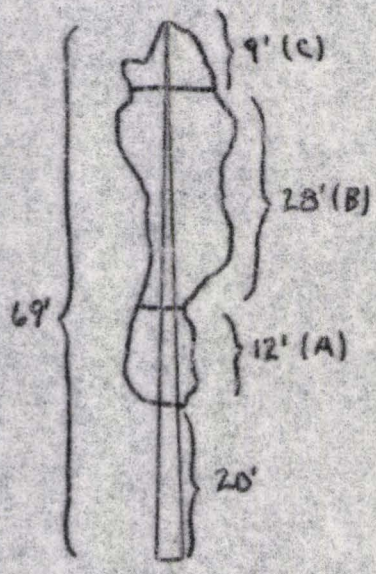
No pitch girdle.
Empty within 3 days, 21 hrs.

First exam: 10-18-37

Slight fade of lower half, none in top half.

Second exam: 12-1-37

Sorrel lower one-half; heavy fade upper one-half



(5)

Results of Quantitative Analyses Showing Copper Distribution

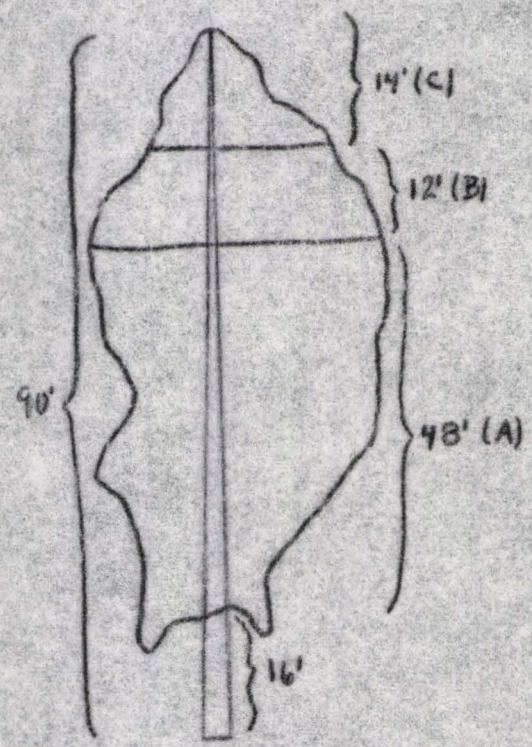
Height: Depth-by $\frac{1}{8}$"-divisions for outer 2" (from outer $\frac{1}{2}$" to fourth $\frac{1}{2}$")				
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	1.25	.27	.05	.00
10	1.55	.17	.05	.00
Base	7.70	.27	.05	.00

INJECTION AND EXAMINATION DATA SHEET

Tree number 223

Crown class	D
Diameter	28 in.
Total height	90 ft.
Logs	4
Volume outer 2 in.	20 cu.ft.
Salman suscept. class	4
Keen tree class.	4B
Dunning tree class.	5

Tree characteristics:
A-good color, medium to long needles, few dead branches, few fading twigs.
B-poor color, thin foliage, dead twigs; fading twigs, dead branches; fading branches.
C-stag top.



(5)

Date treated 9-2-37 (open collar
Method Saw Kerf-rubber band reset with
Copper sulphate (total) 15.0 lbs.
Water (total) 10.0 gals.

Treating remarks:

No pitch girdle.
Tree banded; intake very slow. Reset with open collar. Empty within 4 days.

First exam: 10-18-37

Nearly sorrel lower one-half, with medium fade top one-half.

Second exam: 12-1-37

Heavy fade to sorrel throughout.

Results of Quantitative Analyses Showing Copper Distribution

Height:	Depth-by $\frac{1}{2}$"-divisions for outer 2" (from outer $\frac{1}{2}$" to fourth $\frac{1}{2}$")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.10	.05	.00	.00
10	.30	.13	.05	.00
Base	3.82	.10	.00	.00

INJECTION AND EXAMINATION DATA SHEET

Tree number 224

Crown class	I
Diameter	16 in.
Total height	68 ft.
Logs	2
Volume outer 2 in.	8 cu.ft.
Salman suscept. class	1
Keen tree class.	3D
Dunning tree class.	4

Tree characteristics:

A-good color, long needles, cone crop, thick foliage, occasional dead twigs.

Date treated	9-6-37
Method	Open collar
Copper sulphate (total)	6.0 lbs.
Water (total)	4.0 gals.

Treating remarks:

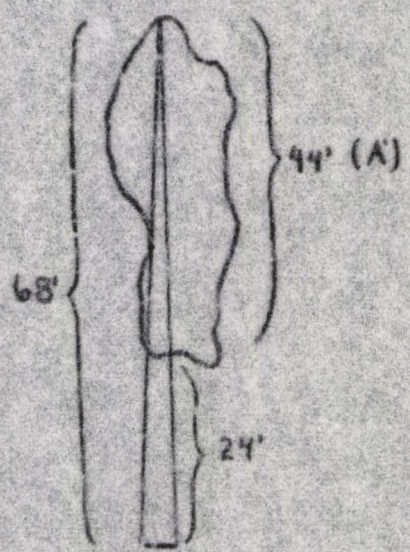
No pitch girdle.
Empty within 3 days; cut made into wood at 7 ft. much copper found on 9-10-37.

First exam: 10-18-37

Nearly sorrel throughout

Second exam: 12-1-37

Sorrel throughout



Results of Quantitative Analyses Showing Copper Distribution

Height	Depth-by $\frac{1}{2}$"-divisions for outer 2" (from outer $\frac{1}{2}$" to fourth $\frac{1}{2}$")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.30	.05	.00	.05
10	.27	.05	.00	.00
Base	.80	.13	.00	.00

INJECTION AND EXAMINATION DATA SHEET

Tree number 225

Crown class	D
Diameter	34 in.
Total height	92 ft.
Logs	4
Volume outer 2 in.	24 cu.ft.
Salman suscept. class	4
Keen tree class.	4A
Dunning tree class.	5

Date treated	9-6-37
Method	Open collar
Copper sulphate (total)	18.0 lbs.
Water (total)	12.0 gals.

Tree characteristics:

A-fair to good color, medium to long needles; dead branches few fading twigs, dead twigs.
B-off-color; many fading twigs; dead twigs; fading branches; medium to short needles, top foliage bunchy.

Treating remarks:

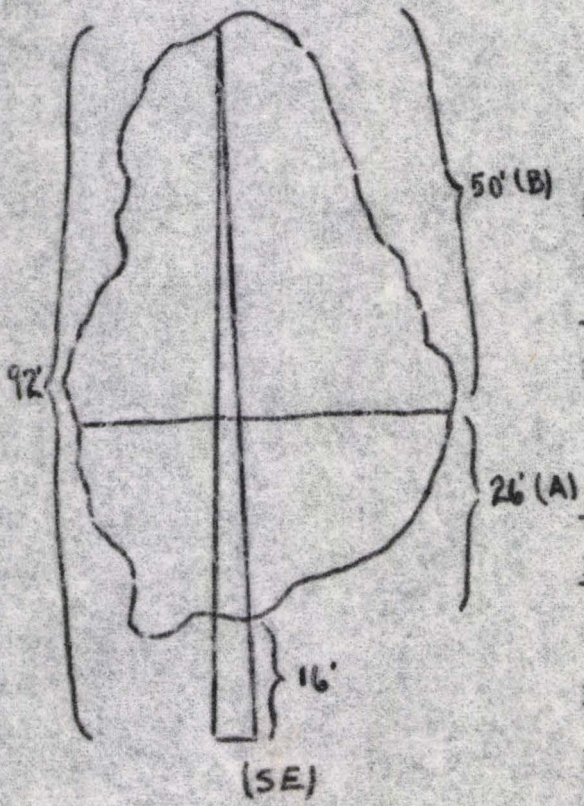
No pitch girdle.
Empty within 3 days.

First exam: 10-18-37

Sorrel bottom few branches with medium fade of lower one-third and little if any fade above.

Second exam: 12-1-37

Sorrel lower one-third; off color upper two-thirds; abundant sorrel and red twigs throughout.



Results of Quantitative Analyses Showing Copper Distribution

Height:	Depth-by $\frac{1}{2}$"-divisions for outer 2" (from outer $\frac{1}{2}$" to fourth $\frac{1}{2}$")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.35	.05	.00	.00
10	.57	.10	.00	.00
Base	1.55	.10	.00	.00

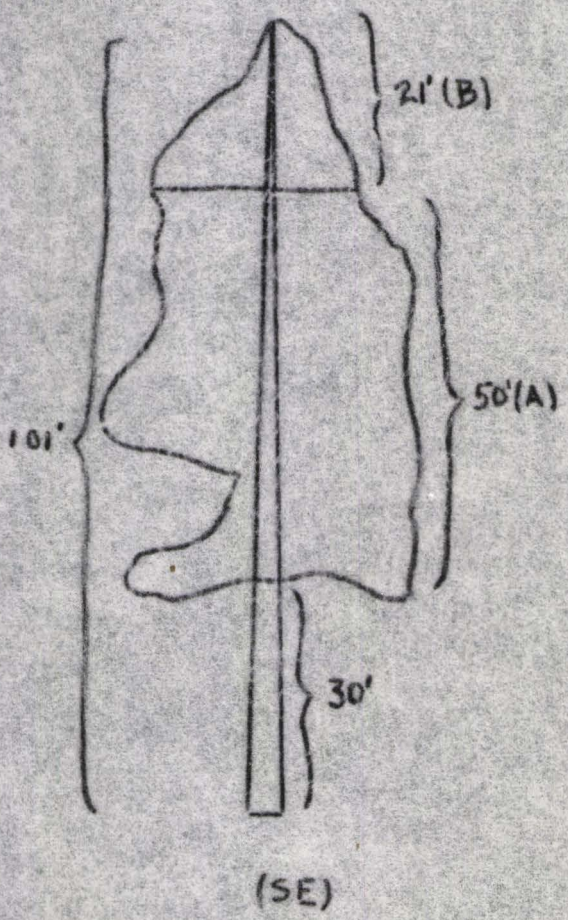
INJECTION AND EXAMINATION DATA SHEET

Tree number 226

Crown class	D
Diameter	32 in.
Total height	101 ft.
Logs	5
Volume outer 1 in.	12 cu.ft.
Salman suscept. class	4
Keen tree class.	4B
Dunning tree class.	5

Tree characteristics:

A-good color long needles, cone crop, thick foliage.
B-poor color; short to medium needles; dead twigs, fading twigs, bunchy foliage.



Date treated	9-6-37
Method	Open collar
Copper sulphate (total)	9.0 lbs.
Water (total)	6.0 gals.

Treating remarks:

No pitch girdle.
Empty within 23 hrs.

First exam: 10-18-37

One sorrel lowest branch but practically no fade above.

Second exam: 12-1-37

Lowest branch sorrel; remainder fair green; possibly two fading branches in mid-crown; sorrel twigs scattered in top.

Results of Quantitative Analyses Showing Copper Distribution

Height :	Depth-by $\frac{1}{2}$"-divisions for outer 2" (from outer $\frac{1}{2}$" to fourth $\frac{1}{2}$")			
:	1	2	3	4
Feet :	Pounds of copper per cubic foot			
20 :	.17	.05	.00	.00
10 :	.17	.00	.00	.00
Base :	1.12	.07	.00	.00

INJECTION AND EXAMINATION DATA SHEET

Tree number 227

Crown class	D
Diameter	15 in.
Total height	56 ft.
Logs	1
Volume outer 1 in.	3 cu.ft.
Salman suscept. class	3
Keen tree class.	2C
Dunning tree class.	2

Tree characteristics:

A-dead branches.
B-poor color, short needles, bunchy foliage; dead branches, fading twigs.

Date treated	9-6-37
Method	Open collar
Copper sulphate (total)	2.25 lbs.
Water (total)	1.5 gals.

Treating remarks:

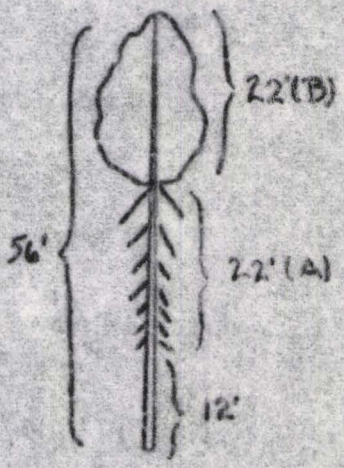
No pitch girdle.
Empty within 22½ hrs.

First exam: 10-18-37

Slight fade throughout.

Second exam: 12-1-37

Green; few red twigs in top.



Results of Quantitative Analyses Showing Copper Distribution

Height:	Depth-by ½"-divisions for outer 2" (from outer ½" to fourth ½")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.10	.00	.00	.00
10	.15	.05	.00	.00
Base	2.10	.10	.05	.00

INJECTION AND EXAMINATION DATA SHEET

Tree number 228

Crown class	D	Date treated	9-6-37
Diameter	17 in.	Method	Open collar
Total height	61 ft.	Copper sulphate (total)	3.0 lbs.
Logs	1	Water (total)	2.0 gals.
Volume outer 1 in.	4 cu.ft.		
Salman suscept. class	1		
Keen tree class.	2C		
Dunning tree class.	2		

Tree characteristics:

A-good color, long needles, few dead branches and twigs

Treating remarks:

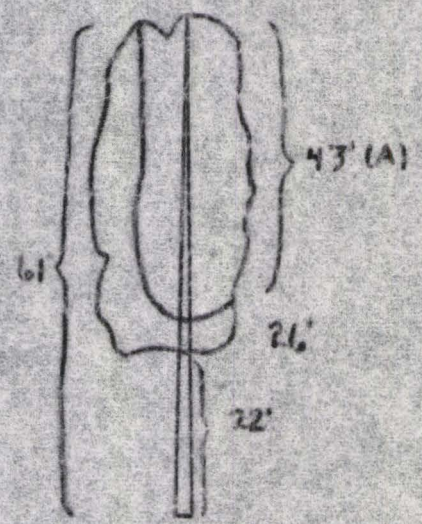
No pitch girdle.
Empty within 22 hrs.

First exam: 10-18-37

Sorrel bottom to medium top fade.

Second exam: 12-1-37

Sorrel throughout.



Results of Quantitative Analyses Showing Copper Distribution

Height	Depth-by $\frac{1}{8}$"-divisions for outer 2" (from outer $\frac{1}{8}$" to fourth $\frac{1}{8}$")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.15	.05	.00	.00
10	.10	.00	.00	.00
Base	1.32	.07	.00	.00

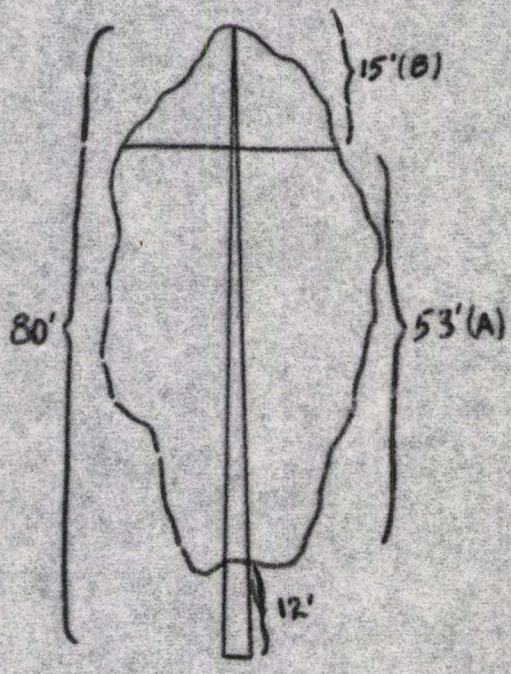
INJECTION AND EXAMINATION DATA SHEET

Tree number 229

Crown class	D
Diameter	21 in.
Total height	80 ft.
Logs	3
Volume outer 2 in.	11 cu.ft.
Salman suscept. class	4
Keen tree class.	2A
Dunning tree class.	1

Tree characteristics:

A-fair color, medium needles, dead branches, scattered dead twigs, fade in top few branches short needles near top, thin foliage.
B-Old TK.



Date treated 9-7-37
Method Bore-holes, reset with open collar
Copper sulphate (total) 8.25 lbs.
Water (total) 5.5 gals.

Treating remarks:

No pitch girdle
Two connecting bore-holes made 9-6-37.
9-7-37 holes pitched in; more holes made, also pitched in.
Reset with collar.
Empty within 17 hrs.

First exam: 10-18-37

Heavy fade of lower half to light top fade.

Second exam: 12-1-37

Sorrel lower two-thirds; medium fade top one-third with abundant red twigs.

Results of Quantitative Analyses Showing Copper Distribution

Height	Depth-by $\frac{1}{2}$"-divisions for outer 2" (from outer $\frac{1}{2}$" to fourth $\frac{1}{2}$")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.20	.07	.05	.00
10	.13	.05	.05	.00
Base	.45	.13	.05	.00

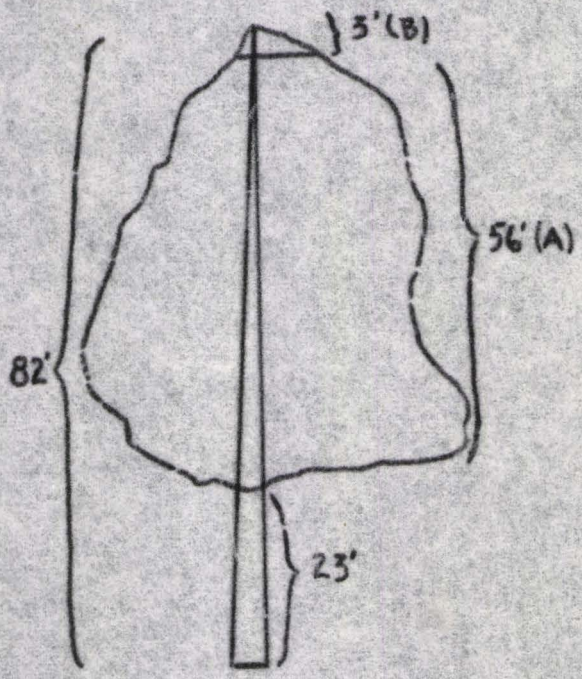
INJECTION AND EXAMINATION DATA SHEET

Tree number 230

Crown class	D
Diameter	23 in.
Total height	82 ft.
Logs	4
Volume outer 1 in.	6 cu.ft.
Salman suscept. class	4
Keen tree class.	3B
Dunning tree class.	3

Tree characteristics:

A-poor color, short needles, bunchy foliage, dead branches, and twigs; fading twigs, thin foliage.
B-TK. Foliage gone.



Date treated 9-8-37
Method Bore-holes, reset with open collar
Copper sulphate (total) 4.5 lbs.
Water (total) 3.0 gals.

Treating remarks:

No pitch girdle.
Two connecting bore-holes made 9-6-37.
Another set of connecting bore-holes made 9-7-37.
Holes pitched in; intake very slow;
Reset with open collar.
Nearly empty at end of 4½ hrs.

First exam: 10-18-37

Heavy fade of lower one-half, to medium top fade.

Second exam: 12-1-37

Heavy fade to sorrel throughout.

Results of Quantitative Analyses Showing Copper Distribution

Height: Feet	Depth-by $\frac{1}{8}$"-divisions for outer 2" (from outer $\frac{1}{2}$" to fourth $\frac{1}{2}$")			
	1	2	3	4
	Pounds of copper per cubic foot			
20	.15	.07	.05	.05
10	.13	.07	.00	.00
Base	.22	.05	.00	.00

INJECTION AND EXAMINATION DATA SHEET

Tree number 231

Crown class	D
Diameter	39 in.
Total height	144 ft.
Logs	5
Volume outer 1 in.	22 cu.ft.
Salman suscept. class	4
Keen tree class.	4C
Dunning tree class.	5

Date treated	9-6-37
Method	Open collar
Copper sulphate (total)	16.5 lbs.
Water (total)	11.0 gals.

Tree characteristics:

A-fair color, medium to long needles, fading twigs, dead twigs and dead branches.
B-old TK. in part-south side. Active fade, short needles, bunchy foliage and dead twigs.

Treating remarks:

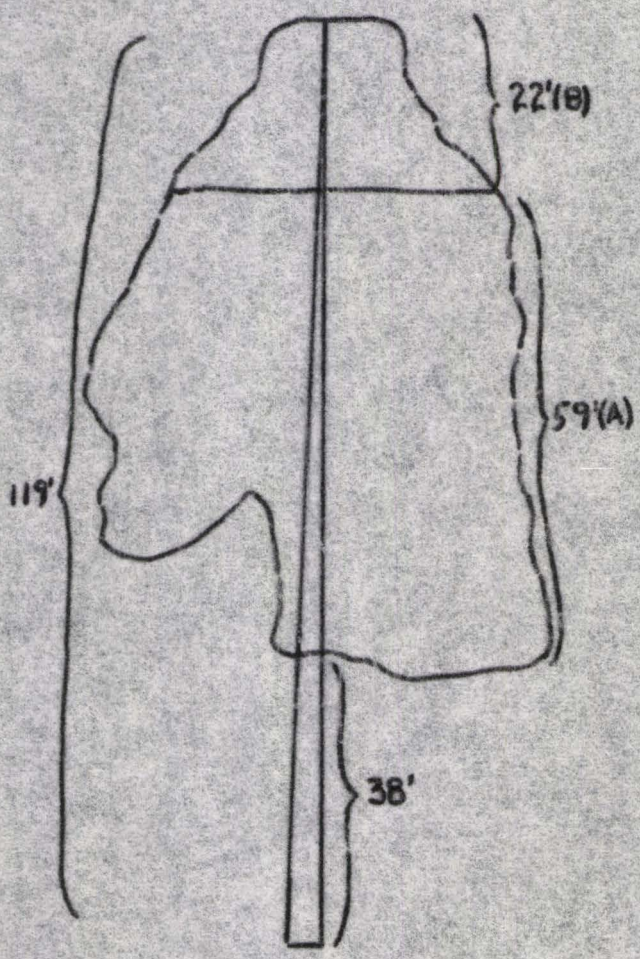
No pitch girdle.
Fire scar at base - collar put above it.
Empty within 1 day, 21 hrs.

First exam: 10-18-37

No discernible fade.

Second exam: 12-1-37

Possibly light fade of one lower branch; remainder good green throughout; top with red twigs in dead TK.



Results of Quantitative Analyses Showing Copper Distribution

Height	Depth-by $\frac{1}{8}$"-divisions for outer 2" (from outer $\frac{1}{8}$" to fourth $\frac{1}{8}$")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.22	.05	.00	.07
10	.25	.10	.10	.00
Base	.95	.10	.00	.05

INJECTION AND EXAMINATION DATA SHEET

Tree number 232

Crown class	D
Diameter	27 in.
Total height	116 ft.
Logs	5
Volume outer 1 in.	12 cu.ft.
Balman suscept. class	3
Keen tree class.	3B
Dunning tree class.	3

Date treated	9-6-37
Method	Open collar
Copper sulphate (total)	9.0 lbs.
Water (total)	6.0 gals.

Treating remarks:

No pitch girdle.
Empty within 20 hrs.

Tree characteristics:

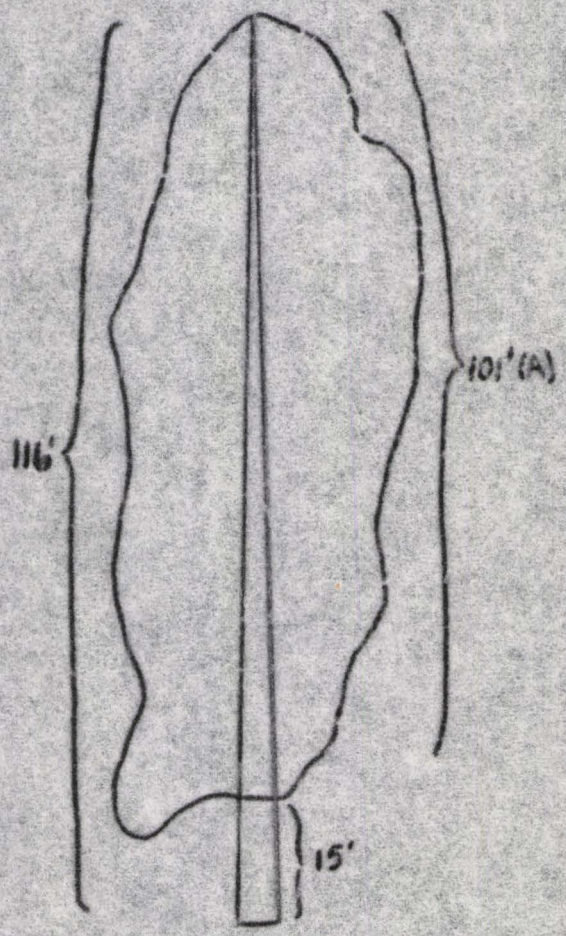
A-fair color, medium to long needles, thin foliage, dead twigs, and branches, fading twigs, dead leader.

First exam: 10-18-37

Medium fade of lower third to light fade, top two-thirds.

Second exam: 12-1-37

Sorrel two lowest branches, fair green above with scattered sorrel twigs.



Results of Quantitative Analyses Showing Copper Distribution

Height:	Depth-by $\frac{1}{2}$"-divisions for outer 2" (from outer $\frac{1}{2}$" to fourth $\frac{1}{2}$")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.20	.07	.00	.00
10	.25	.05	.05	.13
Base	1.52	.10	.05	.00

INJECTION AND EXAMINATION DATA SHEET

Tree number 233

Crown class	D
Diameter	35 in.
Total height	108 ft.
Logs	6
Volume outer 1 in.	15 cu.ft.
Salman suscept. class	3
Keen tree class.	4B
Dunning tree class.	5

Tree characteristics:

A-good color, medium to short needles; dead branches, bunchy foliage; few fading twigs.

B-short needles, bunchy foliage poor color, fading branches and twigs, dead branches and twigs.

Date treated	9-6-37
Method	Open collar.
Copper sulphate (total)	11.25 lbs.
Water (total)	7.5 gals.

Treating remarks:

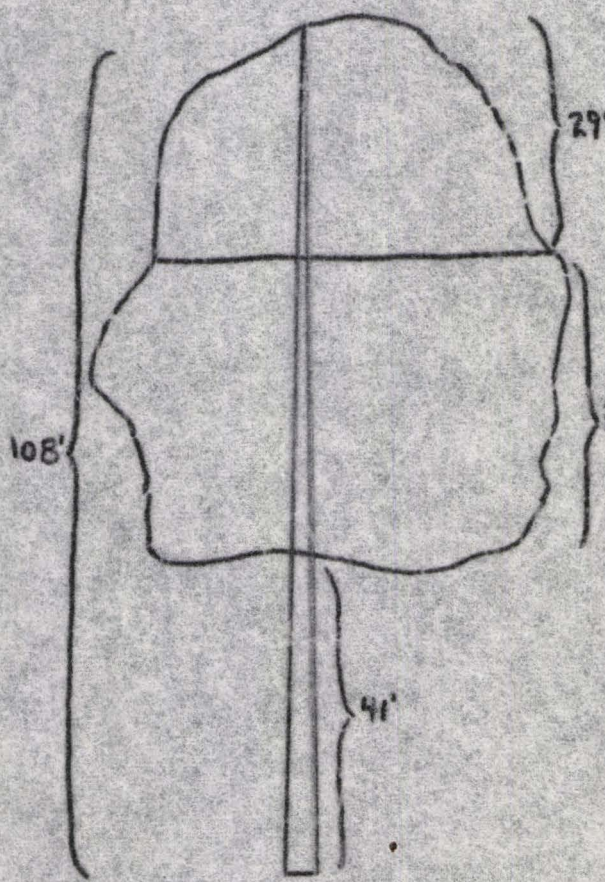
No pitch girdle.
Collar found broken day after treatment set up. Possible loss of chemical.
Reset with 5 gallons of solution.
Very small amount left at end of 2 days, 21½ hrs. - very pitchy.

First exam: 10-18-37

Heavy fade lower few branches, with very little fade above.

Second exam: 12-1-37

Heavy fade to sorrel lower two-thirds with one green branch; top one-third with scattered abundant sorrel twigs.



Results of Quantitative Analyses Showing Copper Distribution

Height	Depth-by ½"-divisions for outer 2" (from outer ½" to fourth ½")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.10	.05	.05	.00
10	.13	.05	.00	.05
Base	1.07	.10	.00	.00

INJECTION AND EXAMINATION DATA SHEET

Tree number 234

Crown class	C
Diameter	19 in.
Total height	85 ft.
Logs	4
Volume outer 1 in.	7 cu.ft.
Salman suscept. class	3
Keen tree class.	3C
Dunning Tree class.	4

Tree characteristics:

A-poor color, short needles, bunchy foliage, dead branches, fading twigs, dead twigs.

Date treated	9-6-37
Method	Open collar
Copper sulphate (total)	5.25 lbs.
Water (total)	3.5 gals.

Treating remarks:

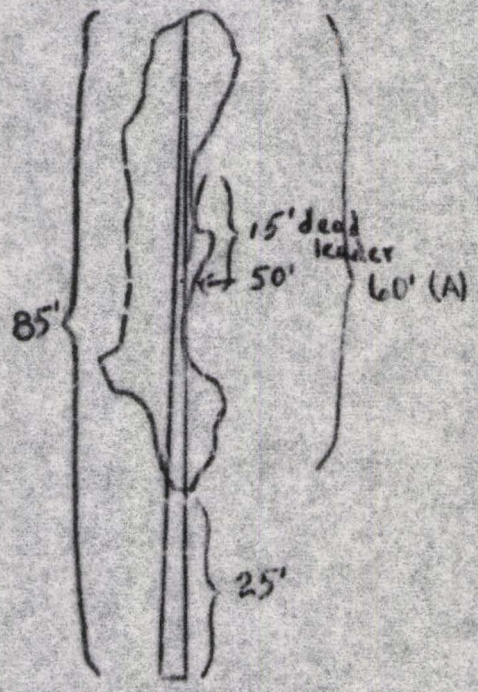
No pitch girdle.
Empty within 19 hrs.

First exam: 10-18-37

Little if any fade.

Second exam: 12-1-37

Fair green throughout; no true fade; few red twigs in very top.



Results of Quantitative Analyses Showing Copper Distribution

Height	Depth-by $\frac{1}{8}$"-divisions for outer 2" (from outer $\frac{1}{8}$" to fourth $\frac{1}{8}$")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.52	.10	.00	.00
10	.65	.07	.05	.00
Base	9.35	.07	.05	.10

INJECTION AND EXAMINATION DATA SHEET

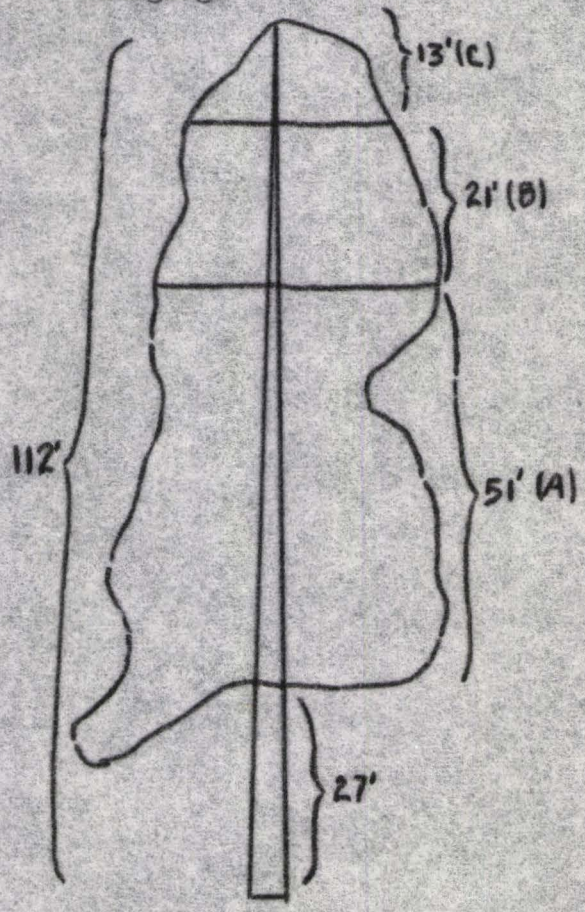
Tree number 235

Crown class	D
Diameter	39 in.
Total height	112 ft.
Logs	4
Volume outer 1 in.	17 cu.ft.
Salman suscept. class	4
Keen tree class.	4B
Dunning tree class.	5

Date treated	9-7-37
Method	Open collar
Copper sulphate (total)	12.75 lbs.
Water (total)	8.5 gals.

Tree characteristics:

A-good color, long needles, dead twigs and branches.
B-short needles, poor color, fading branches and twigs, dead branches and twigs, bunchy foliage, active fade.
C-old TK; few needles still clinging.



Treating remarks:

No pitch girdle.
Empty within 23 hrs.
D. valens beetle in tree beneath collar in pitch colored with copper sulphate.

First exam: 10-18-37

Little if any fade.

Second exam: 12-1-37

Heavy fade lower two-thirds with few sorrel branches; upper one-third medium fade with abundant red twigs; few scattered green branches.

Results of Quantitative Analyses Showing Copper Distribution

Height:	Depth-by $\frac{1}{8}$"-divisions for outer 2" (from outer $\frac{1}{8}$" to fourth $\frac{1}{8}$")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.10	.00	.00	.00
10	.22	.05	.00	.00
Base	2.37	.05	.00	.00

INJECTION AND EXAMINATION DATA SHEET

Tree number 236

Crown class	I
Diameter	18 in.
Total height	59 ft.
Logs	1
Volume Outer 1 in.	3 cu.ft.
Salman suscept. class	4
Keen tree class.	3C
Dunning tree class.	4

Tree characteristics:

A-poor color, medium to short needles, fading twigs, dead branches and twigs, bunchy foliage, thin foliage.

Date treated	9-7-37
Method	Open collar
Copper sulphate (total)	2.25 lbs.
Water (total)	1.5 gals.

Treating remarks:

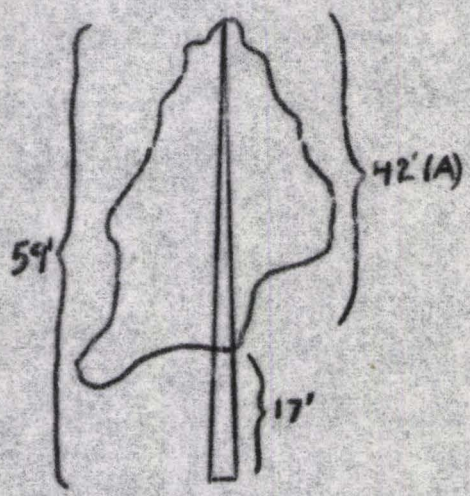
No pitch girdle.
Empty within 6 hrs.

First exam: 10-18-37

Nearly sorrel throughout.

Second exam: 12-1-37

Heavy fade throughout; scattered green needles



Results of Quantitative Analyses Showing Copper Distribution

Height: Depth-by $\frac{1}{2}$"-divisions for outer 2" (from outer $\frac{1}{2}$" to fourth $\frac{1}{2}$")				
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.10	.15	.05	.05
10	.07	.05	.05	---
Base	.47	.05	.05	.05

INJECTION AND EXAMINATION DATA SHEET

Tree number 237

Crown class	D
Diameter	17 in.
Total height	56 ft.
Logs	1
Volume outer 1 in.	4 cu.ft.
Salman suscept. class	4
Keen tree class.	2A
Dunning tree class.	1

Tree characteristics:

A-fair color, medium needles, dead branches, thin foliage.
B-short needles, active TK; bunchy foliage, dead twigs and branches, top few feet previous TK.

Date treated	9-7-37
Method	Open collar
Copper sulphate (total)	3.0 lbs.
Water (total)	2.0 gals.

Treating remarks:

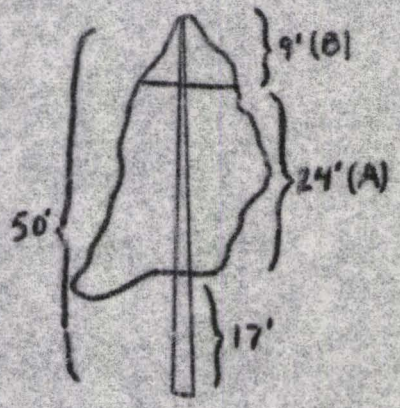
No pitch girdle.
Empty within 22½ hrs.

First exam: 10-18-37

Sorrel bottom to no fade of top half.

Second exam: 12-1-37

Sorrel with green needles scattered on twigs; red twigs in top.



Results of Quantitative Analyses Showing Copper Distribution

Height: Feet	Depth-by ½"-divisions for outer 2" (from outer ½" to fourth ½")			
	1	2	3	4
	Pounds of copper per cubic foot			
20	.15	.05	.05	.05
10	.30	.07	.05	.05
Base	3.65	.15	.00	.05

INJECTION AND EXAMINATION DATA SHEET

Tree number 238

Crown class	D
Diameter	24 in.
Total height	95 ft.
Logs	4
Volume outer 1 in.	8.5 cu.ft.
Salman suscept. class	4
Keen tree class.	4B
Dunning tree class.	5

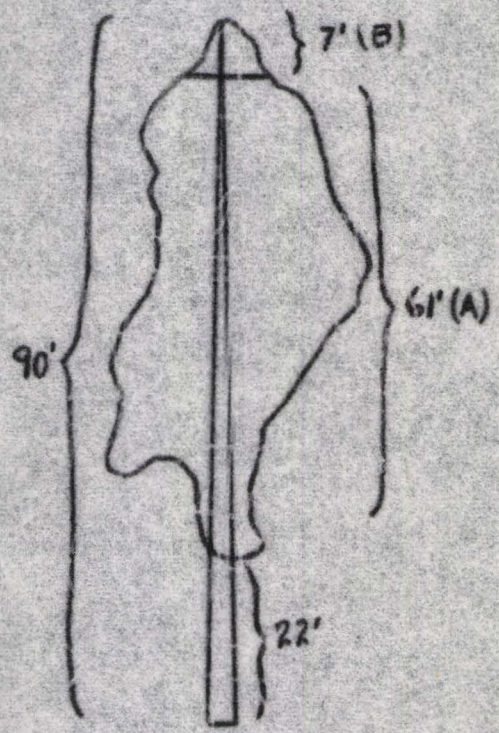
Date treated	9-7-37
Method	Open collar
Copper sulphate (total)	6.5 lbs.
Water (total	4.25 gals.

Treating remarks:

No pitch girdle.
Empty within 26 hrs.

Tree characteristics:

A-good color at base, long needles, few dead branches, fading twigs in top, bunchy foliage near top; fair color at top, dead twigs in top.
B-active fade, short needles, bunchy foliage, dead twigs and branches.



First exam: 10-18-37

Light fade lower one-third to none in top two-thirds.

Second exam: 12-1-37

Heavy fade to sorrel lower one-half; off color top with scattered sorrel needles.

Results of Quantitative Analyses Showing Copper Distribution

Height:	Depth-by $\frac{1}{2}$"-divisions for outer 2" (from outer $\frac{1}{2}$" to fourth $\frac{1}{2}$")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.15	.05	.05	.05
10	.22	.05	.05	.05
Base	3.80	.10	.05	.05

INJECTION AND EXAMINATION DATA SHEET

Tree number 251

Crown class	I
Diameter	19 in.
Total height	81 ft.
Logs	3
Volumm outer 1 in.	6 cu.ft.
Salman suscept. class	3
Keen tree class.	3C
Dunning tree class.	4

Tree characteristics:

A-fair color, medium needles, thin foliage, scattered dead twigs and branches.

Date treated	9-7-37
Method	Open collar
Copper sulphate (total)	4.5 lbs.
Water (total)	3.0 gals.

Treating remarks:

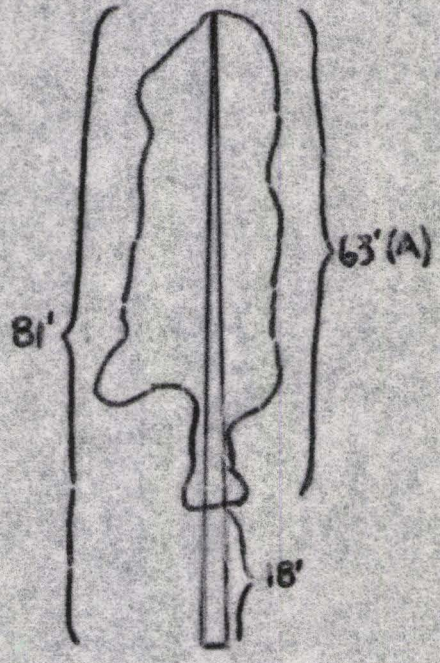
No pitch girdle.
Two lightning scars requiring partial collar; about one-fifth of circumference collared.
Empty within 48 hrs.

First exam: 10-18-37

Possibly light fade throughout.

Second exam: 12-1-37

Poor green throughout; possibly light fade.



Results of Quantitative Analyses Showing Copper Distribution

Height:	Depth-by $\frac{1}{8}$"-divisions for outer 2" (from outer $\frac{1}{8}$" to fourth $\frac{1}{8}$")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.22	.05	.00	---
10	.55	.15	.05	.05
Base	.60	.13	.05	.05

INJECTION AND EXAMINATION DATA SHEET

Tree number 252

Crown class	D
Diameter	25 in.
Total height	82 ft.
Logs	3
Volume outer 1 in.	7 cu.ft.
Salman suscept. class	4
Keen tree class.	4B
Dunning tree class.	5

Tree characteristics:

A-fair color, medium needles, bunchy foliage, dead twigs, and branches, fading twigs and branches.

Date treated	9-7-37
Method	Open collar
Copper sulphate (total)	5.25 lbs.
Water (total)	3.5 gals.

Treating remarks:

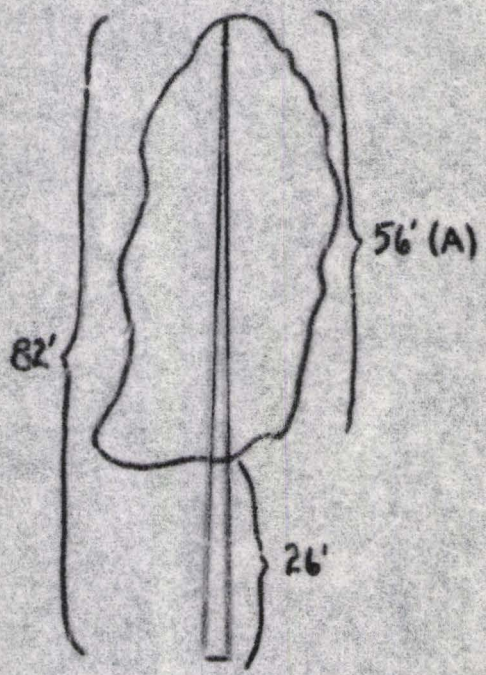
No pitch girdle.
Empty within 25 hrs.

First exam: 10-18-37

Little if any fade.

Second exam: 12-1-37

Lowest branches with scattered sorrel needles; top good green with few sorrel needles.



Results of Quantitative Analyses Showing Copper Distribution

Height:	Depth-by $\frac{1}{2}$"-divisions for outer 2" (from outer $\frac{1}{2}$" to fourth $\frac{1}{2}$")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.20	.07	.00	.00
10	.60	.13	.00	.05
Base	1.95	.35	.00	.00

INJECTION AND EXAMINATION DATA SHEET

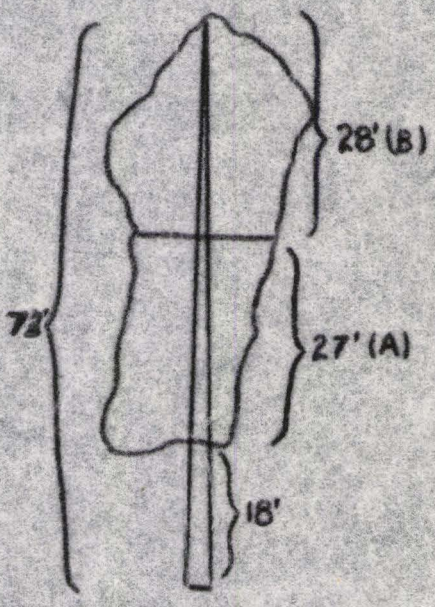
Tree number 253

Crown class	D
Diameter	18 in.
Total height	72 ft.
Logs	2
Volume outer 1 in.	4 cu.ft.
Salman suscept. class	4
Keen tree class.	3C
Dunning tree class.	4

Tree characteristics:

A-good color, long needles, few dead branches.

B-poor color, short needles, dead branches and dead twigs, thin foliage, fading twigs and branches.



Date treated	9-7-37
Method	Open collar
Copper sulphate (total)	3.0 lbs.
Water (total)	2.0 gals.

Treating remarks:

No pitch girdle.
Empty within 25 hrs.

First exam: 10-18-37

Nearly sorrel lower half to light fade top half.

Second exam: 12-1-37

Sorrel lower one-half; medium fade upper one-half with sorrel TK.

Results of Quantitative Analyses Showing Copper Distribution

Height: Depth-by $\frac{1}{8}$"-divisions for outer 2" (from outer $\frac{1}{8}$" to fourth $\frac{1}{8}$")				
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.15	.00	.00	.00
10	.22	.07	.07	---
Base	1.23	.07	.00	.00

INJECTION AND EXAMINATION DATA SHEET

Tree number 254

Crown class	D
Diameter	34 in.
Total height	138 ft.
Logs	4
Volume outer 1 in.	19 cu.ft.
Salman suscept. class	3
Keen tree class.	4C
Dunning tree class.	5

Date treated	9-7-37
Method	Open collar
Copper sulphate (total)	14.25 lbs.
Water (total)	9.5 gals.

Treating remarks:

No pitch girdle.
Empty within 24 hrs.

Tree characteristics:

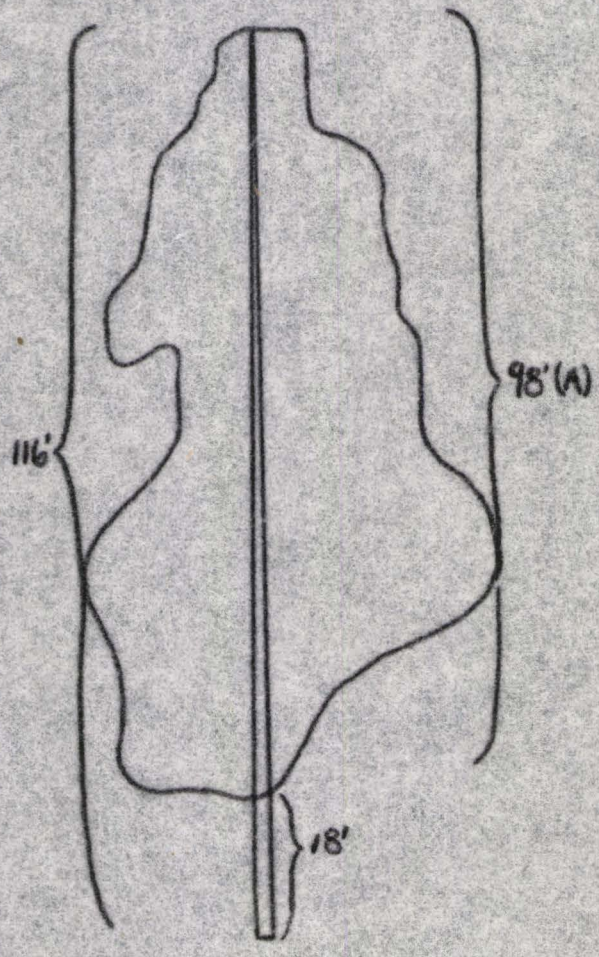
A-fair color, medium needles, bunchy foliage, dead branches, fading top, dead twigs, scattered fading twigs.

First exam: 10-18-37

No discernible fade.

Second exam: 12-1-37

Several scattered branches with sorrel or fading needles; mostly good green.



Results of Quantitative Analyses Showing Copper Distribution

Height:	Depth-by $\frac{1}{2}$"-divisions for outer 2" (from outer $\frac{1}{2}$" to fourth $\frac{1}{2}$")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.10	.05	.00	.--
10	.42	.10	.00	.05
Base	3.77	.55	.15	.05

INJECTION AND EXAMINATION DATA SHEET

Tree number 255

Crown class	C
Diameter	21 in.
Total height	68 ft.
Logs	2
Volume outer 1 in.	5 cu.ft.
Balman suscept. class	3
Keen tree class.	3C
Dunning tree class.	4

Tree characteristics:

A-medium needles, fair color, dead branches and twigs, scattered fading twigs, leader dead, bunchy foliage.

Date treated	9-7-37
Method	Open collar
Copper sulphate (total)	3.75 lbs.
Water (total)	2.5 gals.

Treating remarks:

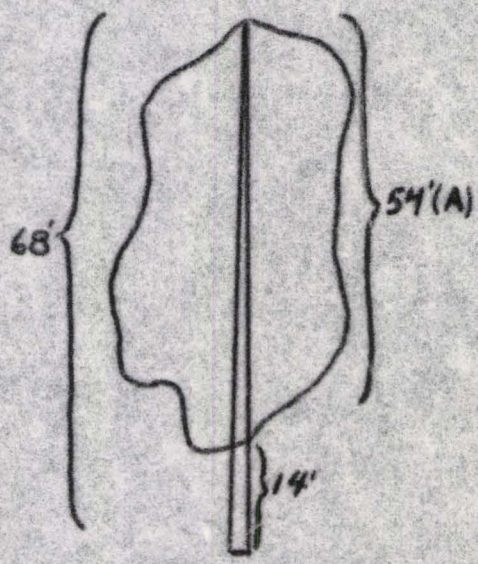
No pitch girdle.
Empty within 24 hrs.

First exam: 10-18-37

Little if any fade.

Second exam: 12-1-37

Fair green; one fading lower branch; few scattered sorrel twigs.



Results of Quantitative Analyses Showing Copper Distribution

Height	Depth-by $\frac{1}{2}$"-divisions for outer 2" (from outer $\frac{1}{2}$" to fourth $\frac{1}{2}$")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.17	.05	.00	.05
10	.15	.05	.05	---
Base	3.02	.10	.05	.05

INJECTION AND EXAMINATION DATA SHEET

Tree number 256

Crown class	C
Diameter	18 in.
Total height	69 ft.
Logs	1
Volume outer 1 in.	4 cu.ft.
Salmon suscept. class	3
Keen tree class.	3C
Dunning tree class.	4

Date treated	9-7-37
Method	Open collar
Copper sulphate (total)	3.0 lbs.
Water (total)	2.0 gals.

Treating remarks:

No pitch girdle.
Empty within 23 hrs.

Tree characteristics:

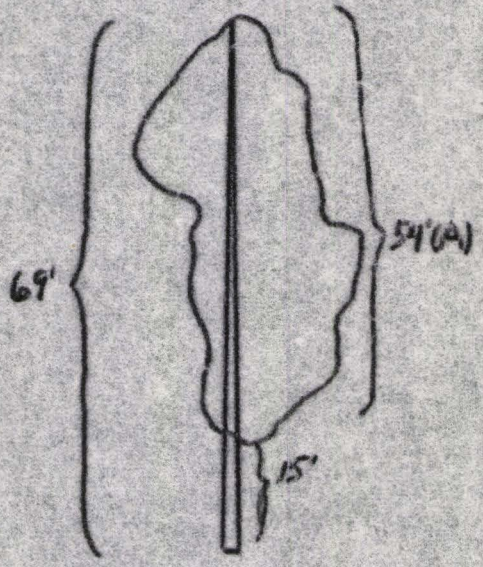
A-medium to short needles,
poor color bunchy foliage,
dead twigs and branches,
fading twigs.

First exam: 10-18-37

Little if any fade.

Second exam: 12-1-37

Fair green; numerous scattered sorrel twigs; two fading lower branches.



Results of Quantitative Analyses Showing Copper Distribution

Height:	Depth-by $\frac{1}{2}$"-divisions for outer 2" (from outer $\frac{1}{2}$" to fourth $\frac{1}{2}$")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.25	.05	.05	.05
10	.42	.05	.05	.05
Base	2.07	.07	.05	.05

INJECTION AND EXAMINATION DATA SHEET

Tree number 257

Crown class	C
Diameter	25 in.
Total height	90 ft.
Logs	3
Volume outer 1 in.	8 cu.ft.
Salman suscept. class	4
Keen tree class.	3B
Dunning tree class.	3

Tree characteristics:

A-medium to short needles, fair to poor color, dead branches and twigs, fading twigs, bunchy foliage.

Date treated	9-7-37
Method	Open collar.
Copper sulphate (total)	6.0 lbs.
Water (total)	4.0 gals.

Treating remarks:

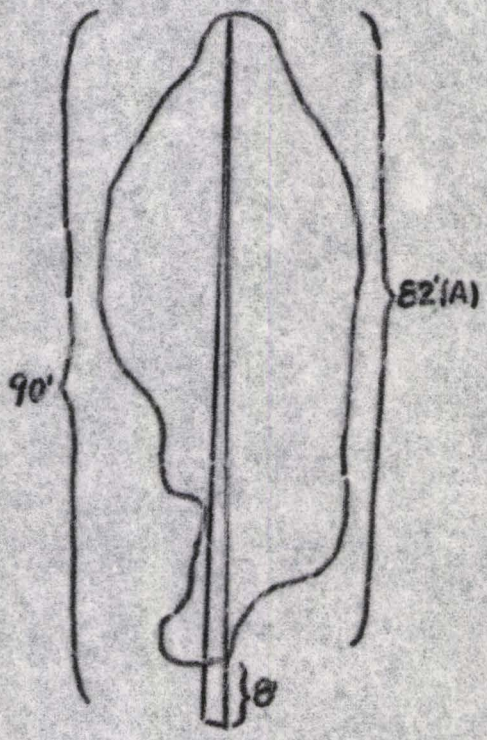
No pitch girdle.
Empty within 24 hrs.

First exam: 10-18-37

Two lowest branches nearly sorrel with little if any fade above.

Second exam: 12-1-37

Heavy fade lower branches; fair green upper with abundant sorrel twigs and sorrel few feet TK.



Results of Quantitative Analyses Showing Copper Distribution

Height	Depth-by $\frac{1}{2}$"-divisions for outer 2" (from outer $\frac{1}{2}$" to fourth $\frac{1}{2}$")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.25	.05	.05	.05
10	.25	.05	.00	.07
Base	.47	.20	.13	.05

INJECTION AND EXAMINATION DATA SHEET

Tree number 258

Crown class	D
Diameter	37 in.
Total height	103 ft.
Logs	4
Volume outer 1 in.	14 cu.ft.
Salman suscept. class	3
Keen tree class.	4B
Dunning tree class.	5

Date treated	9-7-37
Method	Open collar
Copper sulphate (total)	10.5 lbs.
Water (total)	7.0 gals.

Tree characteristics:

A-fair color, long to medium needles, dead twigs and branches, fading twigs bunchy foliage near top.

Treating remarks:

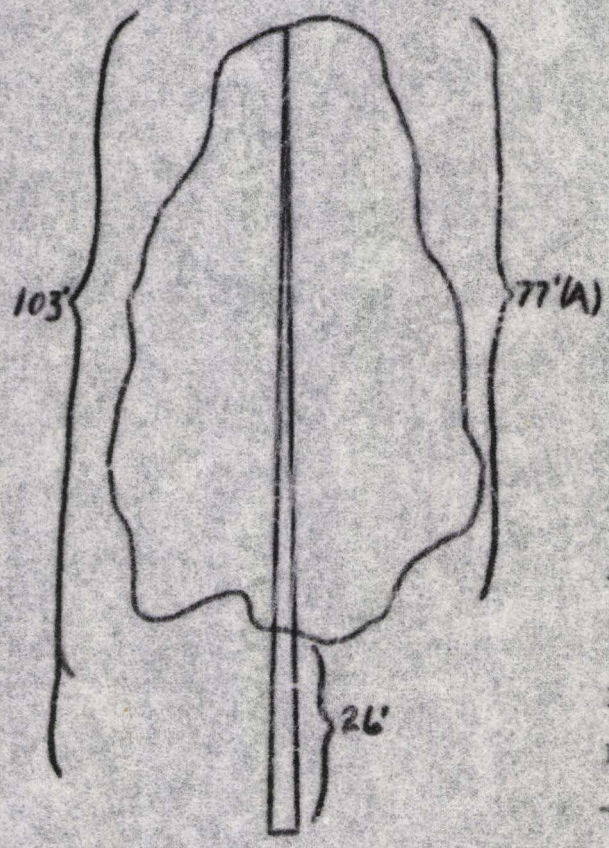
No pitch girdle.
Empty within 24 hrs.

First exam: 10-18-37

Little if any fade.

Second exam: 12-1-37

Fair green with scattered off-color branches and twigs.



Results of Quantitative Analyses Showing Copper Distribution

Height: Feet	Depth-by $\frac{1}{8}$"-divisions for outer 2" (from outer $\frac{1}{8}$" to fourth $\frac{1}{8}$")			
	1	2	3	4
	Pounds of copper per cubic foot			
20	.15	.05	.05	.05
10	.22	.05	.05	.05
Base	4.30	.05	.05	.05

INJECTION AND EXAMINATION DATA SHEET

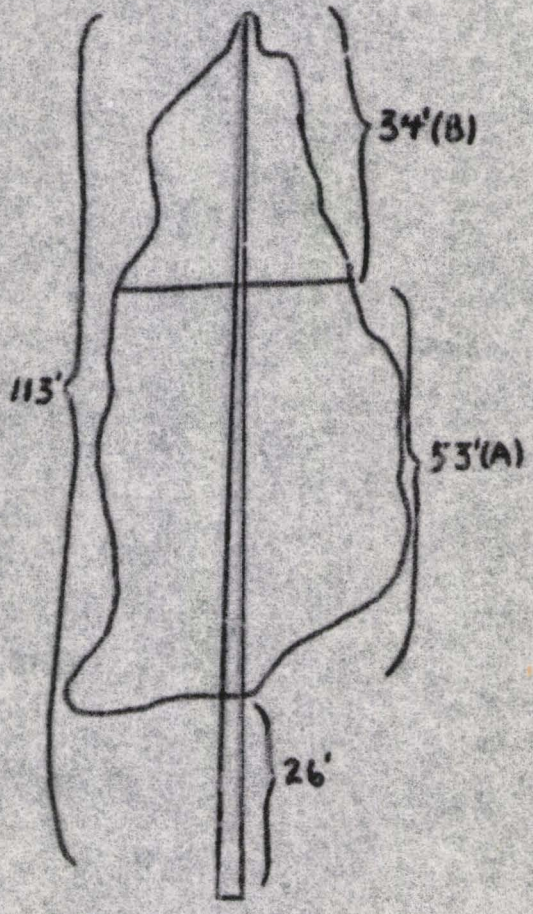
Tree number 259

Crown class	D
Diameter	33 in.
Total height	113 ft.
Logs	4
Volume outer 1 in.	15 cu.ft.
Salman suscept. class	3
Keen tree class.	4B
Dunning tree class.	5

Tree characteristics:

A-good color, long needles, few dead branches and twigs.

B-very thin crown, dead branches, medium needles, bunchy foliage, poor color.



Date treated	9-9-37
Method	Open collar
Copper sulphate (total)	11.25 lbs.
Water (total)	7.5 gals.

Treating remarks:

No pitch girdle.
Empty within 24 hrs.

First exam: 10-18-37

Heavy fade of lower one-third with little if any above.

Second exam: 12-1-37

Lowest branches good green; few sorrel lower branches; possibly light fade above with scattered sorrel twigs.

Results of Quantitative Analyses Showing Copper Distribution

Height:	Depth-by $\frac{1}{8}$"-divisions for outer 2" (from outer $\frac{1}{8}$" to fourth $\frac{1}{8}$")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.40	.10	.05	.05
10	.17	.05	.05	.05
Base	4.47	.15	.05	.05

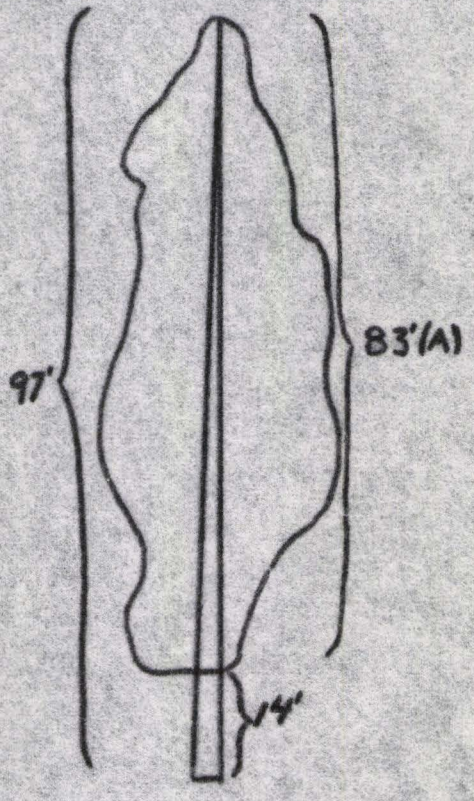
INJECTION AND EXAMINATION DATA SHEET

Tree number 260

Crown class	D
Diameter	28 in.
Total height	97 ft.
Logs	4
Volume outer 1 in.	11 cu.ft.
Salman suscept. class	4
Keen tree class.	4C
Dunning tree class.	5

Tree characteristics:

A-fair color, long to medium needles bunchy foliage in top, dead twigs and branches, fading twigs in top, short needles on very top.



Date treated	9-9-37
Method	Open collar
Copper sulphate (total)	8.25 lbs.
Water (total)	5.5 gals.

Treating remarks:

No pitch girdle.
Empty within 22.5 hrs.

First exam: 10-18-37

Nearly sorrel throughout.

Second exam: 12-1-37

Sorrel throughout.

Results of Quantitative Analyses Showing Copper Distribution

Height:	Depth-by $\frac{1}{2}$"-divisions for outer 2" (from outer $\frac{1}{2}$" to fourth $\frac{1}{2}$")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.20	.05	.05	.05
10	.20	.05	.05	.05
Base	1.97	.13	.05	.05

INJECTION AND EXAMINATION DATA SHEET

Tree number 262

Crown class	I
Diameter	22 in
Total height	105 ft.
Logs	4
Volume outer 1 in.	8.5 cu.ft.
Balman suscept. class	4
Keen tree class.	3B
Dunning tree class.	4

Tree characteristics:

A-fair color, medium needles, some bunchy foliage, dead twigs and branches, scattered fading twigs.
B-active fade, short needles, dead twigs and branches, leader dead, thin foliage, fading top.

Date treated	9-9-37
Method	Open collar
Copper sulphate (total)	6.5 lbs.
Water (total)	4.25 gals.

Treating remarks:

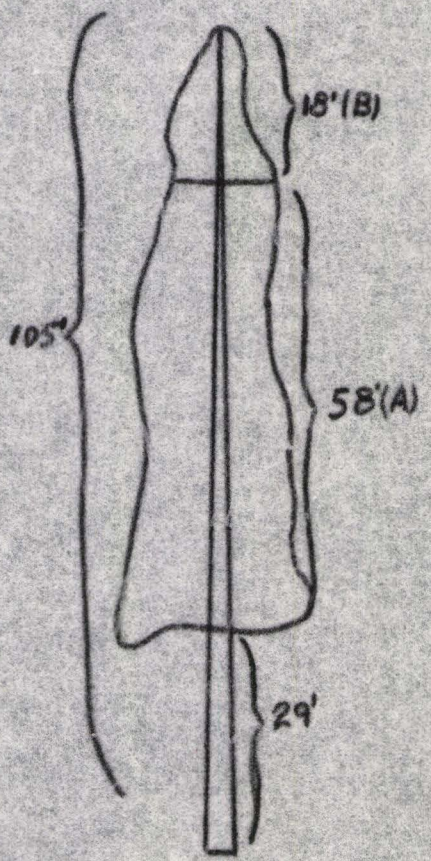
No pitch girdle.
Empty within 22 hrs.

First exam: 10-18-37

Felled.

Second exam: 12-1-37

Felled.



Results of Quantitative Analyses Showing Copper Distribution

Height:	Depth-by $\frac{1}{8}$"-divisions for outer 2" (from outer $\frac{1}{8}$" to fourth $\frac{1}{8}$")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.20	.05	.05	.05
10	.92	.10	.05	.05
Base	2.72	.07	.05	.05

INJECTION AND EXAMINATION DATA SHEET

Tree number 263

Crown class	I
Diameter	20 in.
Total height	71 ft.
Logs	3
Volume outer 1 in.	5 cu.ft.
Salman suscept. class	4
Keen tree class.	3C
Dunning tree class.	2

Tree characteristics:

A-fair color, medium needles, thin foliage, dead twigs and branches, fading twigs.

Date treated	9-9-37
Method	Open collar
Copper sulphate (total)	3.75 lbs.
Water (total)	2.5 gals.

Treating remarks:

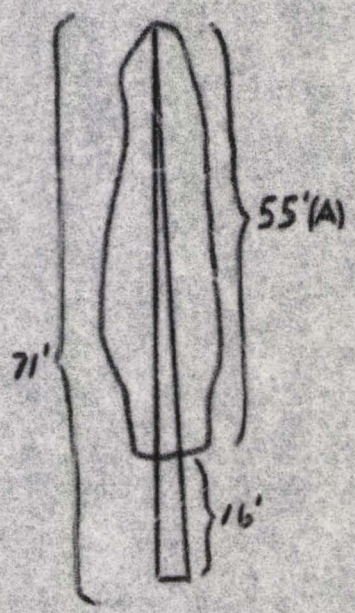
No pitch girdle.
Empty within 22 hrs.

First exam: 10-18-37

Little if any fade.

Second exam: 12-1-37

Off-color throughout; fade of lower branches; abundant sorrel to red twig on south side and in top.



Results of Quantitative Analyses Showing Copper Distribution

Height:	Depth-by $\frac{1}{8}$"-divisions for outer 2" (from outer $\frac{1}{8}$" to fourth $\frac{1}{8}$")			
	1	2	3	4
Feet	Pounds of copper per cubic foot			
20	.17	.05	.05	.05
10	.38	.07	.05	.05
Base	1.12	.10	.05	.05

The following sets of treatments of individual trees are given to show the possible trends in similarities and differences of chemical distribution in trees having different characteristics or subjected to different methods of treatment. In each comparison the point to be considered is underlined for emphasis.

Results of Quantitative Analyses Showing
Copper Distribution

Height	Depth-by $\frac{1}{8}$"-divisions for outer 2" (from outer $\frac{1}{8}$" to fourth $\frac{1}{8}$")							
Feet	Pounds of copper per cubic foot							
	1	2	3	4	1	2	3	4
20	.17	.15	.05	.00	.05	.10	.05	.00
10	.20	.15	.10	.00	.30	.20	.05	.05
Base	4.25	.17	.05	.07	.25	.15	.05	.05

	Tree #211	Tree #202
Crown class	D	C
Diameter	14 in.	14 in.
Height	55 ft.	58 ft.
Volume outer 2 in.	5 cu.ft.	4 cu.ft.
Salman tree class	4	3
Method	Saw kerf-rubber band	Open collar
Copper sulphate	3.75 lb.	3.0 lb.
Water	2.5 gal.	2.0 gal.

Main point of difference between tree #211 and tree #202 is the method of treatment.

Some characteristics and treatments of tree #202 as compared to tree #211 are: a difference in crown class, a difference in volume and a difference in the amount of chemical used.

Results of Quantitative Analyses Showing Copper Distribution

Height	Depth-by $\frac{1}{8}$"-divisions for outer 2" (from outer $\frac{1}{8}$" to fourth $\frac{1}{8}$")											
Feet	Pounds of copper per cubic foot											
	1	2	3	4	1	2	3	4	1	2	3	4
20	.20	.15	.07	.07	1.25	.27	.05	.00	.22	.10	.00	.00
10	.25	.15	.05	.00	1.55	.17	.05	.00	.25	.13	.10	.10
Base	.83	.20	.05	.05	7.70	.27	.05	.00	3.70	.40	.25	.07

	Tree #206	Tree #222	Tree #220
Crown class	D	D	C
Diameter	18 in.	14 in.	18 in.
Height	60 ft.	69 ft.	84 ft.
Volume outer 2 in.	7 cu.ft.	7 cu.ft.	11 cu.ft.
Salman tree class.	4	3	4
Method	Saw kerf-rubber band	Open collar	Open collar
Copper sulphate	5.25 lbs.	5.25 lbs.	8.25 lbs.
Water	3.5 gal.	3.5 gals.	5.5 gals.

Main points of difference between tree #206 and the other 2 trees; tree #222 and tree #220, is the method of treatment.

Some characteristics and treatments of tree #222 as compared to tree #206 are: a difference in diameter, same volume and consequently same amount of chemical; of tree #220 as compared to tree #206 are: slight difference in crown class, same diameter but different volume, and consequently different amount of chemical.

Results of Quantitative Analyses Showing
Copper Distribution

Height	Depth-by $\frac{1}{8}$"-divisions for outer 2" (from outer $\frac{1}{8}$" to fourth $\frac{1}{8}$")											
Feet	Pounds of copper per cubic foot											
	1	2	3	4	1	2	3	4	1	2	3	4
20	.30	.05	.00	.05	.45	.10	.00	.05	.25	.10	.00	.00
10	.27	.05	.00	.00	.55	.07	.00	.05	.22	.10	.05	.00
Base	.80	.13	.00	.00	5.05	.10	.00	.00	3.80	.15	.07	.13

	Tree #224	Tree #218	Tree #216
Crown class	I	I	C
Diameter	16 in.	16 in.	20 in.
Height	68 ft.	63 ft.	75 ft.
Volume outer 2 in.	8 cu.ft.	6 cu.ft.	9 cu.ft.
Salman tree class.	1	4	3
Method	Open collar	Open collar	Open collar
Copper sulphate	6.0 lb.	4.5 lb.	6.75 lb.
Water	4.0 gal.	3.0 gal.	4.5 gal.

Main point of difference between tree #224 and the other 2 trees, tree #218 and tree #216 is Salman tree classification.

Some characteristics and treatments of tree #218, as compared to tree #224, are as follows: same crown class and same diameter, but differs in volume and consequently in amount of chemical used. Those of tree #216 are: different crown class, different diameter, but slightly less difference in volume and consequently less difference in amount of chemical used.

Results of Quantitative Analyses Showing
Copper Distribution

Height	Depth-by ½"-divisions for outer 2" (from outer ½" to fourth ½")							
Feet	Pounds of copper per cubic foot							
	1	2	3	4	1	2	3	4
20	.15	.05	.00	.00	.15	.05	.05	.05
10	.10	.00	.00	.00	.30	.07	.05	.05
Base	1.32	.07	.00	.00	3.65	.15	.00	.05

	Tree #228	Tree #237
Crown class	D	D
Diameter	17 in.	17 in.
Height	61 ft.	56 ft.
Volume outer 1 in.	4 cu.ft.	4 cu.ft.
Salman tree class.	1	4
Method	Open collar	Open collar
Copper sulphate	3.0 lb.	3.0 lbs.
Water	2.0 gal.	2.0 gals.

Main point of difference between tree #228 and tree #237 is Salman tree classification.

Results of Quantitative Analyses Showing
Copper Distribution

Height	Depth-by ½"-divisions for outer 2" (from outer ½" to fourth ½")							
Feet	Pounds of copper per cubic foot							
	1	2	3	4	1	2	3	4
20	.17	.05	.00	.00	.38	.10	.00	.00
10	.17	.00	.00	.00	.20	.15	.05	.05
Base	1.12	.07	.00	.00	1.40	.00	.00	.00

	Tree #226	Tree #205
Crown class	D	D
Diameter	32 in.	32 in.
Height	101 ft.	105 ft.
Volume outer 1 in.	12 cu.ft.	outer 2 in. 25 cu.ft.
Salman tree class	4	4
Method	Open collar	Open collar
Copper sulphate	9.0 lb.	18.75 lb.
Water	6.0 gal.	12.5 gal.

Main point of difference between tree #226 and tree #205 is the amount of chemical used as based on difference in volume measurements.

Fig. 1

Fig. 2

Fig. 3